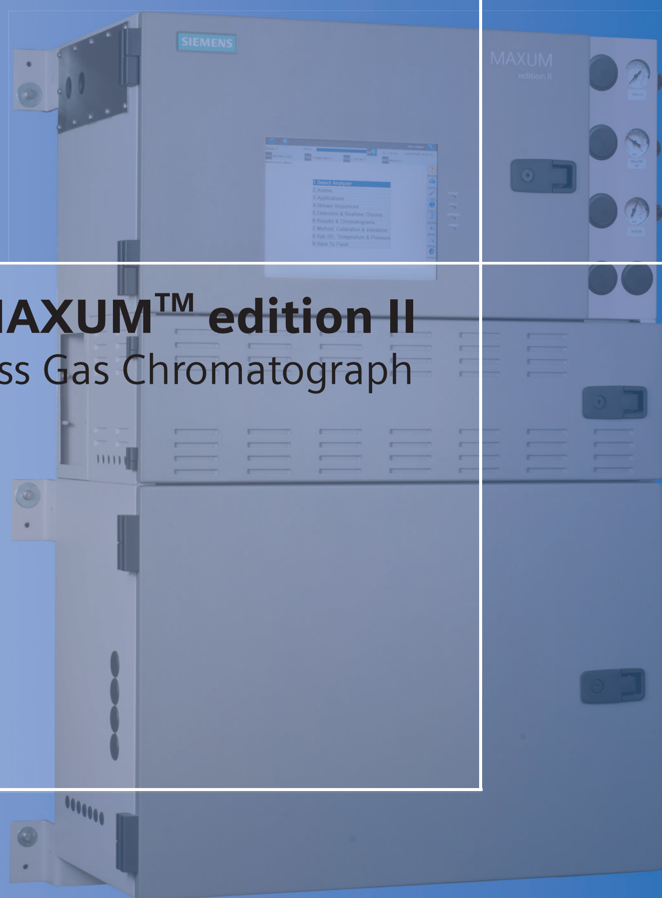
Maintenance Manual Edition 2/2015



MAXUM™ edition II

Process Gas Chromatograph

process

GAS CHROMATOGRAPHY

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Chapter 1

Knowing Your System

Introduction

Overview

The Maxum edition II system, hereafter referred to as Maxum II, represents a significant advance in process chromatography. This was accomplished by combining the best of the Siemens Advance Maxum and PGC 302 gas chromatographs into a single platform analyzer. From oven and electronic components to software and communication networks, the system is modular. Pre-configured application modules are available for many common measurements.

A Maxum II system offers a wide range of detector modules including Thermal Conductivity, Flame Ionization, Flame Photometric, and the Pulsed Discharge Detector (which can operate in Helium Ionization, Photoionization, and Electron Capture modes). All detector modules are available for both air bath and airless ovens. The Maxum II oven is designed so it can be divided into two independently heated isothermal ovens for parallel chromatography applications. A single air bath oven can accommodate up to 3 detector modules, and an airless oven can house a single detector module in each oven.

The Maxum II Maintenance Panel provides maintenance personnel with access to all maintenance functions and data. In addition, the Maintenance Panel will display both real time and archived chromatograms. A PC based network workstation incorporates Gas Chromatograph Portal software.

In this chapter

This chapter covers the following topics:

Important Information

Included with each analyzer is a custom documentation-drawing package. This package provides drawings and information pertinent only to a specific analyzer. Contents of this package are application dependent and will vary for each analyzer. Typical drawings included are:

System Block and Utility Requirements
System Outline and Dimensional Drawings
Sampling System - Plumbing and Spare Parts List
Sampling System Dimensional Diagram
Sampling Probe
Electronic Enclosure Section - Internal Layout
Applicable Wiring Diagrams
Oven Plumbing Diagram - Sensor Near Electronics
Recommended Spare Parts - Analyzer
Manufacturing Test Charts
Stream Composition Data
Data Base

Maxum II Specifications

Configuration

Oven	Single isothermal air bath oven or split airbath oven with 2 independent isothermal zones or split airbath oven with one side isothermal and one side programmed temperature. Single or dual independent airless ovens. Dual version has two distinct oven compartments for complete operating independence. Any isothermal dual-configuration is rated for up to a maximum temperature differential of 100°C.
Detector Modules	Thermal Conductivity, Flame Ionization, Flame Photometric, or Pulse Discharge Detector (in Helium Ionization, Photoionization, or Electron Capture Mode)
Number of Detector Modules	1, 2, or 3 in any combination of detector module types for air bath oven (except restricted to a single pulse discharge detector). 1 or 2 in any combination of detector module types for airless oven (except restricted to a single pulse discharge detector). Detector combinations can total up to 18 channels.
Sample/Column Valves	Pneumatic-driven diaphragm, diaphragm-plunger, heated liquid injection, rotating, or linear transport
Valveless Option	'Live' Switching
Columns	Packed, micro-packed, or capillary
Gas Supply Regulation	Up to 8 electronic pressure controls and up to 8 mechanical pressure controls

Performance

Minimum Range (general)*	Thermal Conductivity: 0-500 ppm Flame Ionization: 0-1 ppm FPD: 0-1 ppm (application dependent: some lower ranges may be available)
Repeatability (general)*	± 0.5% of full scale for full scale ranges from 2-100%; ± 1% of full scale for full scale ranges from 0.05-2%; ± 2% of full scale for full scale ranges from 50-500 ppm; ± 3% of full scale for full scale ranges from 5-50 ppm; ± 5% of full scale for full scale ranges from 0.5-5 ppm; (All values expressed at 2 times standard deviation and are application dependent.)
Sensitivity*	Varies by component and with application. Specific Minimum Detectable Level of measured components can be estimated for some applications. Consult factory.
Linearity*	± 2% of full scale

*Confirm with application

Maxum II Specifications, Continued

Performance (continued)

Oven Temperature Range (Dependent on T – Rating)	40 to 440°F (5 to 225°C) for airbath oven (dependent on T-rating) 40 to 625°F (5 to 330 ºC) for programmed temperature column compartment 122 to 535°F (50 to 260°C) for airless oven (dependent on T-rating)
Temperature Control	± 0.05°F (± 0.02°C)
Cycle Time	30 seconds to 3 hours (application dependent)
Ambient Temperature Effect	None with electronic pressure control Varying effect with mechanical pressure control
Vibration Effect	Negligible

Communication Options

Serial Output	RS232, RS485 Port 1 – RS223/RS485 (Modbus) Port 2 – RS232/RS485 (Serial Printer) Port 3 – RS223/RS485 (Modbus) Port 4 – RS223/RS485 (Modbus)
Ethernet	Standard Four 10/100BaseT Ethernet connections with RJ45 connectors auto-sense and auto-negotiate Optional (with ESBF board): Three RJ45 plus one Fiber Optic 100Base FX multimode with ST® connector
Redundant Ethernet	Siemens Scalance high speed TCP/IP communication network optional
Data Hiway	Proprietary serial communication network (redundant pair cable)

Input/Output Options

Standard I/O	2 analog outputs; 4 digital outputs (1 indicates system error, 3 are user configurable); 4 digital inputs
Board Slots for Optional I/O	Up to 2
I^2C I/O Boards	I2C AIO:8 analog inputs, 8 analog outputs, 2 digital inputs I2C DIO: 6 digital inputs, 8 digital outputs I2C ADIO:4 analog inputs, 4 analog outputs, 4 digital inputs, and 4 digital outputs Note: The Maxum II is also compatible with original version CAN bus I/O from Siemens. CAN I/O boards have lower I/O channel count and capacity; consult factory for detail as needed

Input/Output Options (continued)

Digital Inputs	Optically coupled with a common for all inputs. Self powered floating contact input, or configurable for sinking or sourcing current. Sourcing current mode: 24V internal isolated supply, with positive terminal of supply at common. Sinking current mode: 5V internal isolated supply, with negative terminal of supply at common.
Digital Outputs	Floating double-throw contacts, maximum contact load rating 1 A at 30 V (AC or DC). External diode shunt suppression should be used for inductive DC loads, preferably at the load.
Analog Inputs	Each input configurable for current or voltage; -20 to +20 mA into 50 ohms or -10 to +10 V with 100K. Ohm input resistance, fully differential. Each differential channel operates within the range of -100 to +100V common mode to chassis ground.
Analog Outputs	0/4 to 20 mA into 750 ohms maximum, common negative pole, galvanically separated from ground, freely connectable to ground.
Termination	Terminal strip for braided or solid cable with maximum section of 16 AWG or 1.5 mm^2.

Gas Sample Requirements

Sample Flow	50-200 cc/min (application dependent)
Sample Filtration	0.1 µm
Minimum Sample Pressure	5 psig (35 kPa), lower pressure optional
Maximum Sample Pressure	75 psig (517 kPa), standard; higher pressure optional
Maximum Sample Temperature	250°F (121°C) standard; higher temperature optional
Material in Contact with Sample	Stainless steel, Teflon©, and polyimide; other material optional

Liquid Sample Requirements

Sample Flow	5-20 cc/min (application dependent)
Sample Filtration	0.3-5 micron (sample valve dependent)
Minimum Sample Pressure	5 psig (35 kPa), standard
Maximum Sample Pressure	300 psig (2070 kPa) standard; higher pressure optional
Maximum Sample Temperature	250°F (121°C) standard; higher temperature optional
Material in Contact with Sample	Stainless steel and Teflon©, other material optional

Installation

Configuration — Single unit with multiple enclosures

Dimensions

Height: 39 3/4” (1010 mm)
Width: 26 1/16” (662 mm)
Depth: 16 3/16” (411 mm)

CAUTION

When mounting the analyzer on a wall, care should be taken to ensure that the wall (vertical mounting surface) can withstand four times the minimum weight of the analyzer when mounted with the appropriate hardware. In some cases, it is recommended that brackets, such as Unistrut or angle iron be added to the mounting surface to help distribute the weight.

Mounting

Wall mount: center to center 44” (1120 mm)
Left side clearance: 18" (460 mm)
Front side clearance: 25 ¾’’ (654 mm)
Right side clearance: 18” (460 mm)

Weight — 170 lb (77 kg) – typical, dependent on application

Enclosure Rating — NEMA 3, IP44 Category 2

EMI/RFI Rating

CE Compliance; certified to 89/336/EC and 2004/108/EC (EMC directive)

CE Compliance; certified to 73/23/EC 2006/95/EC (Low Voltage directive)

Tested per EN 61010-1 / IEC 61010-1

Hazardous Class

Standard Configurations:

- Certified by CSA C/US for use in Class I, Division 1, Groups B,C,D with air or nitrogen purge
- Certified by CSA C/US for use in Class I, Division 2, Groups B,C,D
- Certified according to ATEX with air or nitrogen purge and purge control for Zone 1 or Zone 2 (Ex pyedmib IIB + H2)
- Suitable for use in general purpose and non-hazardous areas.

Important:
General Purpose, Division 2 and Zone 2 applications require environmental purge of Electronic Enclosure (EC) to maintain operation integrity and performance.

PDHID is not rated for hazardous areas.

Altitude

Up to 2000m (6561 ft.) for analyzers using 230 VAC Supply

Up to 3000m (9842 ft.) for analyzers using 115 VAC Supply

Installation (continued)

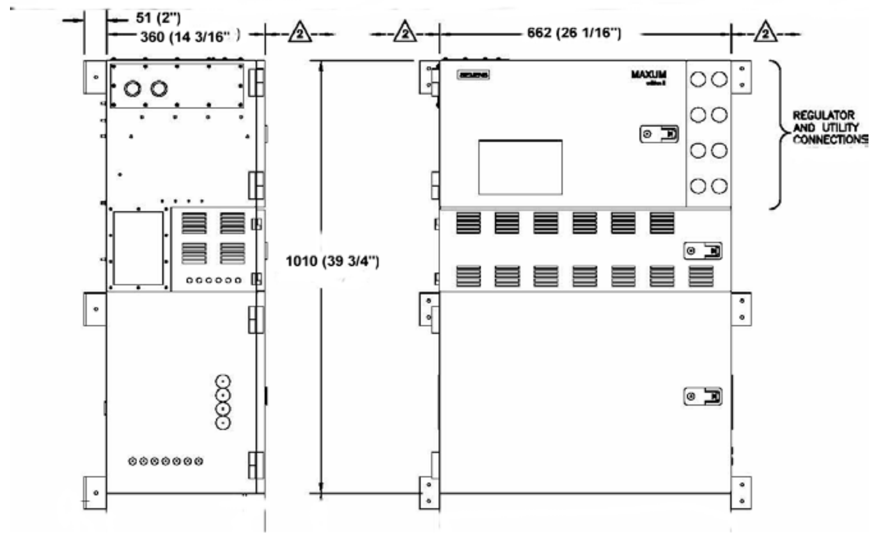
Ambient Temperature and Humidity (for Normal Operation, Storage, and Transport)	0 to 122 °F (-18 to 50°C) (application dependent**) Minimums - 0°F (-18°C) and 0% humidity Maximums – Up to 104°F (40°C) at 50% relative humidity Up to 86°F (30°C) at 80% relative humidity Operational Maximums – The Maxum II may be operated at ambient conditions of up to 122°F (50°C) (application dependent**) and 95% relative humidity provided the electronic doors are not opened and the electronics compartment is purged with clean, dry instrument air. The instrument air must be dry enough to prevent humidity condensation inside the electronics enclosure. Note: If the Maxum II is exposed to high condensing humidity with the electronics open or without dry purge air applied, then it must be allowed to re-stabilize at the above stated conditions for at least 8 hours before electrical power is applied. ** Depending on application characteristics such as number of detectors, oven temperature, and electronic loading, the acceptable ambient temperature range may be reduced. Consult factory for application-specific detail.
AC Power	100-130 VAC or 187-264 VAC (configurable); 47-63 Hz, single phase Typical applications: single circuit, max. 1800 VA Complex applications may require 2 circuits at max. 1800VA per circuit. Wiring should be rated for 80°C (176°F) or higher. Mains buffering (maximum power interruption): >20 ms
Instrument Air	50 psig (345kPa) minimum for units using Model 11 or Valco valves 120 psig (828 kPa) minimum for units using Model 50 valves 25 psig (173 kPa) minimum for air bath oven; 3 scfm (85 liters/minute)/oven No instrument air for airless oven heating (electronics compartment purge still required). 100 psig (690 kPa) minimum for units using Vortex tubes; at dewpoint -40°F (-40°C) 15 scfm (85 liters/minute)
Configuration	Single unit with multiple compartments. Indoor mounting with protection from weather and corrosive or dirty atmosphere is strongly recommended to enhance life and improve maintainability.

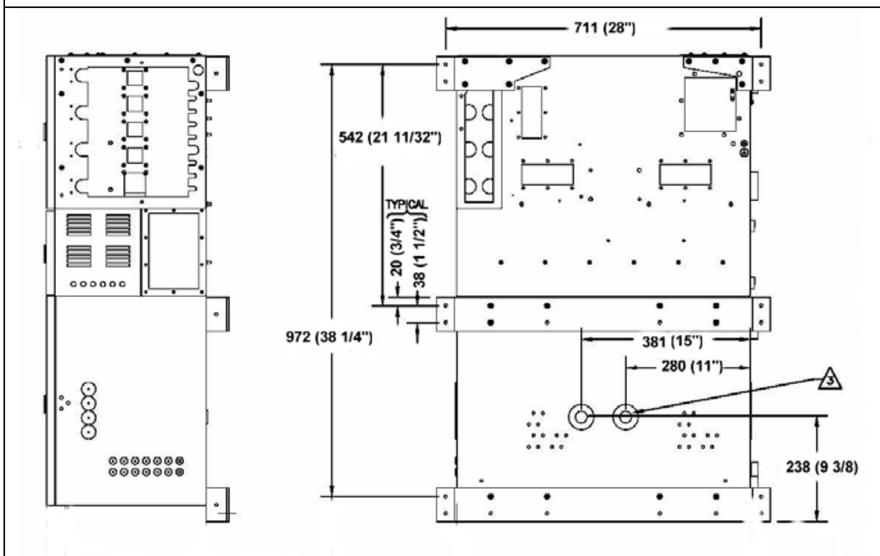
Installation (continued)

Carrier Gas	Cylinder nitrogen, helium, or argon at 99.998% purity, or hydrogen at 99.999% purity depending on application Typical consumption – 180 scf/month/detector module (5100 liters/month/detector module)
Flame Fuel	Hydrogen at 99.999% purity with no more than 0.5 ppm total hydrocarbons Typical consumption – 70 scf/month/detector module (2000 liters/month/detector module)
Flame Air	Zero grade air (< 1ppm THC, O_2 content 20-21%). Supplied from instrument air with catalytic purifier (optional). Typical consumption – 900 scf/month (26,000 liters/month)
Corrosion Protection	Dry air purge to protect electronics. Stainless steel oven protection Painted steel exterior (epoxy powder coat)

Calibration

Type	Manual or automatic
Zero	Automatic baseline correction
Span	Standard sample cylinder





Notes: Unless otherwise specified dimensions are shown as millimeters (inches)

2 Recommended Clearance
Left Side - 460 (18”)
Right Side – 460 (18”)
Front Side – 654 (25 ¾”)
Center to Center – 1120 (44”)

3 Left Exhaust For Single Oven Applications (1”Nipple)
Left and Right Exhaust For Split Oven Applications (1”Nipple)

About The Maxum II

Description

The Maxum II™ GC is completely enclosed in an air-purgable, metal cabinet with hinged doors. Mounted above the isothermal oven is the electronics enclosure and regulator panel. The analyzer may be mounted on a wall, in a rack or on a floor stand.

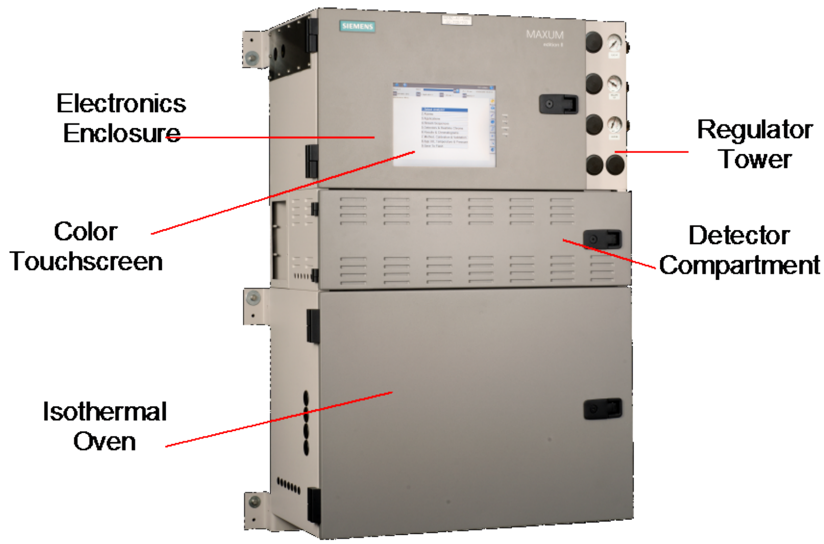


Figure 1-1: Maxum II Process Gas Chromatograph

Electronics Enclosure

The Electronics Enclosure houses all the electronics and pneumatic modules required for performing all temperature, valve control and analysis functions. The Electronics Enclosure modules are interconnected using simple cable connections made to each module. All modules can be easily removed and replaced. The Maxum II software recognizes each Maxum II's application, hardware components and network configurations.

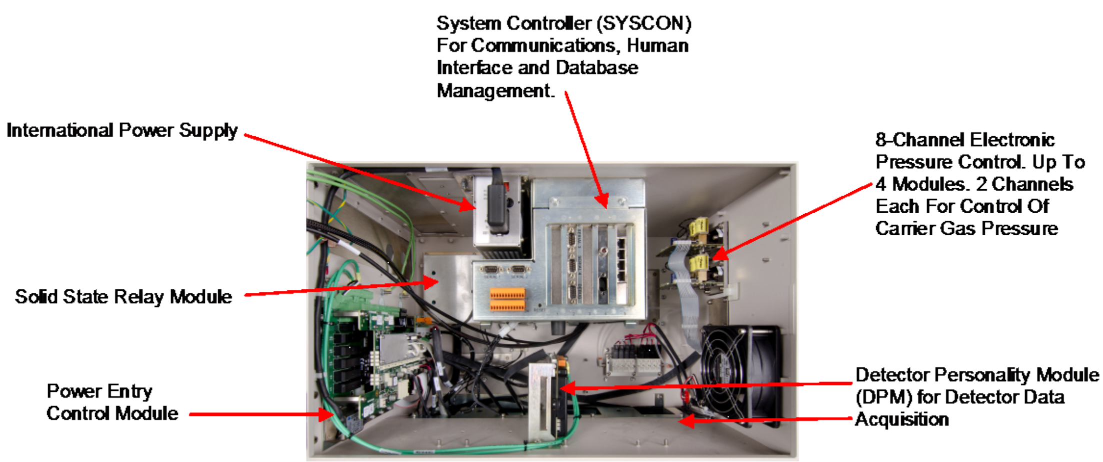


Figure 1-2: Maxum II Electronics Enclosure

Regulator Panel

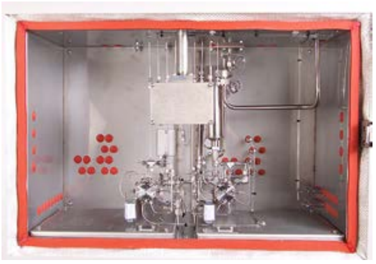
The regulator panel contains space for seven gauges and regulators. The base Maxum II comes with two standard regulators and an electronics enclosure fast purge. See the custom documentation drawing package that was shipped with the analyzer to see which gauges and regulators are mounted on the analyzer.

Isothermal Oven

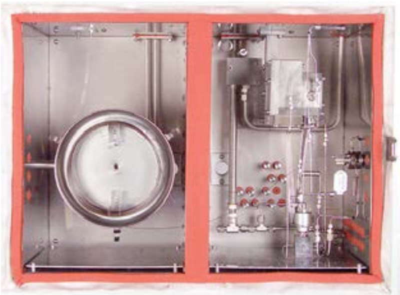
The Maxum II has a wide variety of isothermal oven configurations. Both air bath and airless ovens are available. All air bath configurations are available with Vortex cooling for sub-ambient temperature operation. A program temperature oven option is available for Maxum II applications where isothermal, multi-dimensional chromatography is not practical. Typically the program temperature Maxum II is used for Motor Gasoline (ASTM 3710) & Simulated Distillation (ASTM 2887) applications.

Oven Configurations

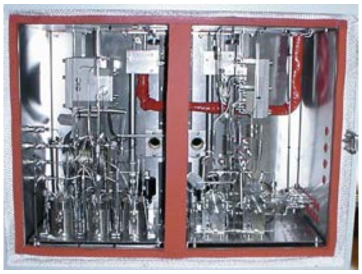
Split Airless: Fully independent dual ovens with separate oven doors. The oven uses cartridge heaters in each side to heat the oven enclosure and its components.



Single Air Bath: Large, spacious compartment for complex applications and for ease of maintenance.



Programmed Temperature Air Bath



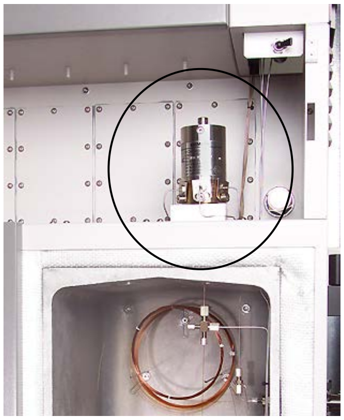
Dual Air Bath: Split Oven Configuration: Offers two temperature zones for one or more applications.

Switching and Sample Valves

The type of valves used in an Maxum II is application dependent.

Application	Model	Description
Vapor Samples	Model 50	10-port plunger-less diaphragm. Contains no moving parts. It will operate over 10 million cycles on clean samples and can operate on carrier gas or other bottled inert gas with negligible consumption. It does the work of two Model 11 valves and is half the size.
Vapor or Liquid Samples	Model 11 and Model 11 LDV	6-port diaphragm–plunger valve high reliability and life. Used as a liquid or vapor sample valve, column switching valve or a column back flush valve. Process lines, columns and valve-to-valve tubes can be connected directly to the caps of the Model 11 LDV (Low Dead Volume) version of the valve.
Vapor or High Pressure Liquid Samples	Model 20	The air-pressure actuated, diaphragm valve provides uniform sample volume, low internal volume, high pressure up to 1500 psi, 10350 kPa, fast switching (milliseconds), reliability, and durability. It functions equally well as a liquid or vapor sample valve, column switching valve, or column back flush valve.
Liquid Sample	LIV	The liquid injection valve can be used to automatically inject a constant quantity of liquid sample followed by fast, complete vaporization. Small gas quantities can also be injected using the valve.
Vapor	Valveless Live Column Switching	The device has no parts to fail or wear out and exhibits essentially zero dead volume for fast column switching and sample injection with capillary columns.

Detectors



Several different types of detector modules are available for the Maxum ll. All of the detector modules can be used in conjunction with both air bath and airless ovens. Depending upon the application requirements, a Maxum II can include up to three detector modules in a single air bath oven, or up to 2 detector modules, one for each oven, in an airless oven.

With the exception of the thermal conductivity detectors, the detector modules are mounted in the detector compartment. The detector compartment is located between the electronics enclosure (EC) and the oven. The detector compartment houses the detector modules and provides a safe path for the electrical connections between the detector modules and the detector personality module (DPM). It also allows the detector to easily connect to the analytical components in the oven. All wiring meets hazardous area and safety requirements. Mineral insulated cable provides the flameproof path for detector cabling from the oven to the electronic enclosure.

Simplicity of the detector design allows the detectors to be easily serviced. The thermal conductivity and filament detectors can be serviced without removing the detectors from the oven.

Type	**Description**
Thermal Conductivity Detector (TCD)	TCD is a concentration response detector for moderate sensitivity of most components. Thermistor TCD: 8-cell thermistor includes six independent measurement cells and two reference cells. Also available in 4-cell version identical to the 8-cell version except equipped with 3 measurement cells and one reference cell. Filament TCD: 2-cell filament TCD can be used as an Inter-column Detector (ITC) in conjunction with a FPD or FID application.
Flame Ionization Detector (FID)	FID is low mass detector for combustible hydrocarbons. The components from the separation column are burned in a hydrogen flame that produces ions. The resultant ionization current is converted to a measurement signal.

Detectors, cont'd

Type	Description
Flame Photometric Detector (FPD)	FPD is a selective detector used to detect substances containing sulfur. The column effluent is fed to a fuel rich hydrogen flame. Optical emissions are generated with wavelengths specific to the sulfur. An optical filter passes only these wavelengths characteristic for sulfur to a photomultiplier where the measurement signal is generated.
Valco Pulse Discharge Detector	The Valco Model D-2 Pulse Discharge Detector (PDD) is manufactured by Valco Instrument Co. Inc. The PDD uses a stable, low powered, pulsed DC discharge in helium as an ionization source. This provides the advantage that the need for a radioactive source is eliminated. However, performance of the PDD is comparable to detectors with conventional radioactive sources. Three variations of the PDD are available for use in the Maxum II Process Chromatograph. These are Helium Ionization (PDHID), Photoionization (PDPID), and Electron Capture (PDECD). For more information regarding this detector and its applicable operating modes refer to the Pulse Discharge Detector Models D-2 and D-2-I Instruction Manual available from Valco Instruments Co. Inc.

Maintenance Panel

The Maintenance Panel displays all maintenance functions and data in a graphical display. In addition it eliminates the need for a chart recorder because it can also display both real-time and stored chromatograms. The real-time chromatograms include zoom and pan features. The stored chromatograms include voltages and cycle times for future comparison. All of the GC's operational and daily routine maintenance tasks can be performed from the Maintenance Panel interactive display screens and menus. System security is assured with multiple levels of password protection for all analyzer-operating functions. A Maintenance Panel emulator (also called a Human Machine Interface, or HMI, emulator) is available from the Maxum System Manager Workstation software. This emulator allows a user to perform Maintenance Panel tasks without being located at the unit.

Work Station

The Maxum II uses a PC based network workstation for programming and data processing. Analyzers can be programmed and monitored from a single location, and, like the Maintenance Panel, the workstation includes graphical displays for operation, maintenance, and diagnostics. It also supports PC printers to print chromatograms and alarm logs in order to meet record keeping requirements.

The Maxum II workstation software, Gas Chromatograph Portal (GCP) is designed for PCs with Microsoft® Windows operating systems. PC workstations can be connected through existing LANs for wide access to monitoring or maintenance tasks. The graphical interface recognizes and displays all network hardware. The system monitors the alarm status of all analyzers connected to the network to centralize system maintenance. More information can be found in the Release Notes file supplied with the GCP Software.

System security is assured with multiple levels of password protection for all analyzer-operating functions.

Chromatography Software

EZChrom© industry specific software is incorporated in the GCP software. This is a laboratory quality application builder developed by Scientific Software, Inc. and includes custom features for the Maxum II. Using EZChrom, it is possible to set up methods and component peak identification. More information can be found in the Release Notes file supplied with the EZChrom software (under the Maxum EZChrom directory).

EZChrom allows a user to choose the best peak gating and basing methods automatically. It is also possible to:

- Re-process captured chromatograms with different methods
- Measure unknown component peaks automatically
- Record multiple detector measurements simultaneously.

Terms

The following are new terms that are used in this manual.

Application refers to the supporting hardware and software required to perform the analysis. Supporting hardware consists of hardware channels: detector channel (AI), Solenoid Valve Control Module channel (AO), Electronic Pressure Control channel (DI), Temperature Controller (DO). Streams are defined to applications. If there are 3 or 4 simultaneous streams, they are defined as a single group called a Method. Applications can run only one Method at a time. Two applications can run if there are two cycle clocks in the Maxum II.

Method is the part of the application that contains the parameters for controlling the hardware. Methods control the hardware associated with an Application. The method tells the hardware what to do, and include all cycle clock timed events. Methods are defined to streams. That is, several stream sequences can make up one Method. Methods also control the integration and calculations of the chromatogram. There is one cycle clock per method.

Applet refers to pre-engineered chromatographic segments of common applications, which have been optimized and standardized.

Applet Module refers to a complete assembly including Model 50 valve(s), detector and interconnecting tubing all mounted as a single module. The module includes columns and restrictors

Parallel Chromatography

With the Maxum II hardware and software, it is possible to take a complex single-train chromatograph analysis and break it into multiple simple trains. Each simple train is then run simultaneously – in parallel. Not only does this procedure simplify the overall analysis, but also it is performed faster and more reliably.

Standard Configurations

Since the chromatography is broken into parallel operating modules, it is possible to use standard configurations for common applications. For example, 95% of the vapor thermal conductivity detector applications in a typical olefins plan can be done with various combinations of fewer than 12 standard mini-applications. Many of these measurements can be performed in less than two minutes. Standard applications modules and methods can be taken off-the-shelf and installed in the analyzer. These mini-applications are referred to as “applets”. Applets can be configured alone or in any combination of parallel groups, depending on the measurement requirements. By using parallel chromatography and applets, it is possible to significantly reduce application development.

Duplicate Modules

Parallel Chromatography can reduce the cycle time for complex applications and also increase chromatograph analysis frequency by running duplicate modules in parallel at staggered times. Since times are staggered the system will provide more frequent measurement updates. If similar measurements are performed on different streams, parallel modules can be used for each stream instead of switching the stream to a single module. This will reduce overall cycle time on multiple stream applications.

Redundant Measurements

Use of parallel chromatography can reduce calibration requirements by running two identical modules in parallel on the same stream to obtain redundant measurements. As long as the results remain the same within a predefined error limit, the analysis is known to be accurate. Deviations outside the error limit can trigger notification or activate analyzer calibration. Overall, the Maxum II calibration requirements are significantly lower because of the parallel measurement configurations and standard modular applications.

Example

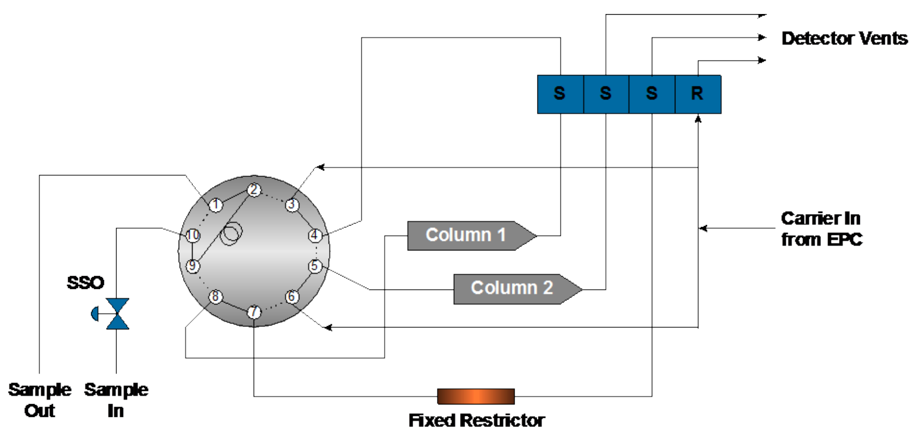


Figure 1-3: Applet Example

Intended Use

The Maxum edition II gas chromatograph is primarily used in all branches of the fine chemicals, refining and hydrocarbon processing industries. It performs chemical composition analysis of gases and liquids that are present in all phases of production. The Maxum II is built for installation in harsh environments either directly or nearby in at-line process measurement laboratories. Its application flexibility allows it to analyze samples of feedstock, partially processed streams, final products and process byproducts including wastes and environmental hazards.

This product is intended to be used only in conjunction with other devices and components which have been recommended and approved by Siemens. Appropriate safety standards were used in the development, manufacture, testing, and documentation of the Maxum II. Under normal operation, this product is safe for use providing that all safety and handling guidelines are observed with respect to configuration, assembly, approved use, and maintenance. This device has been designed such that safe isolation is guaranteed between high and low voltage circuits. Low voltages which are connected must also be generated using safe isolation.

If any part of the Maxum II is opened, certain parts of the device are accessible which may carry dangerous voltages. Therefore, only suitably qualified personnel may work on this device as indicated below in the section titled “Qualified Personnel”.

Qualified Personnel

Only suitably qualified personnel may operate or perform maintenance on the Maxum II. For the purposes of safety, qualified personnel are defined as follows:

1. Those who have been appropriately trained for the tasks which they are performing (for example, commissioning, maintenance, or operation).
2. Those who have been appropriately trained in the operation of automation technology equipment and are sufficiently acquainted with Maxum II documentation.
3. Those who are familiar with the safety concepts of automation technology and are sufficiently acquainted with Maxum II documentation.
4. Those who are authorized to energize, ground and tag circuits and devices in accordance with established safety practices may perform the tasks for which they are trained.

WARNING

Operation or Maintenance of the Maxum II by unqualified personnel or failure to observe the warnings in this manual or on the device may lead to severe personal injury and/or extensive property damage.

Maxum II Operation Overview

Description

This section provides an overview of the operation of the Maxum II analyzer. Figure 1-4 is an operational block diagram showing how a sample is processed within the analyzer. For simplicity the block diagram only depicts a single stream and one detector. The accompanying narrative traces the sample through the Maxum II and how the various modules interact during the analysis. The SNE functions are performed in software in new systems; older systems still have hardware versions.

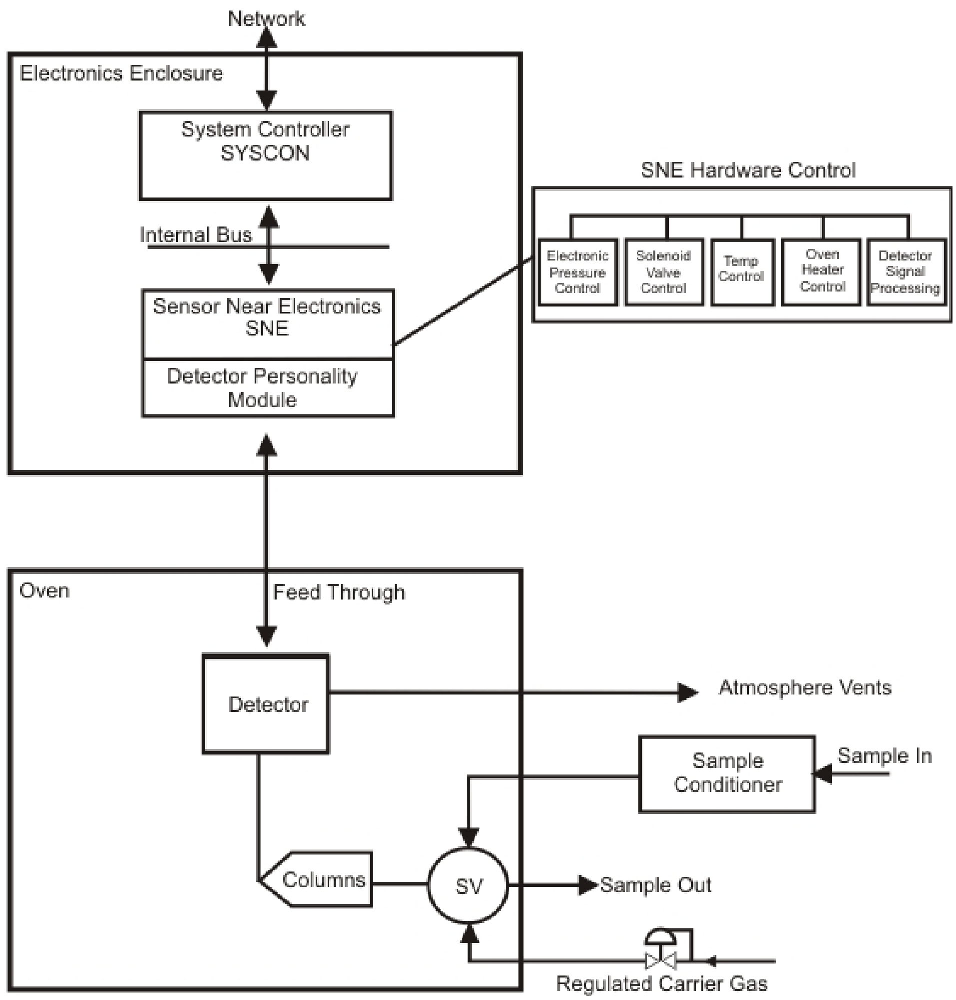


Figure 1-4: Operational Block Diagram

More Information

See Chapter 2, Maxum II Modules.

Analyzer Operation

Refer to Figure 1-4 for the following narrative.

Power On

The Power Entry Control Module (PECM), in response to commands on internal bus, accepts system primary power and provides switching and control of AC power for oven heaters and other AC powered devices.

Sample Conditioning

Before being piped to the analyzer, the sample from the process is sent to a sample conditioner system. The sample conditioner ensures that the process sample is compatible with the requirements of the analyzer. That is, it assures that the phase, pressure, temperature and flow rate to the analyzer are suitable, that the sample is filtered, that condensates are removed and other treatments are carried out. The resultant conditioned sample is piped via 1/8-inch stainless steel tubing to the sample valve(s) located in the oven of the Maxum II.

Sample Valve

The type of sample valve used in a Maxum II is application dependent. Five primary types of sample valves are available. The first is the 10-port Model 50 valve that is designed for vapor sample only. The second is the Model 11 valve for vapor or liquid samples. Third is the Model 20 valve for liquid high-pressure samples. The fourth type the set of Valco valves that are designed for high temperatures and very low sample volumes, and the fifth is the independently heated Siemens Liquid Injection Valve. The sample valve(s) and any column valves are controlled by a Solenoid Valve Control Module located in the Maxum II's electronic enclosure section. There can be up to three SVCMs installed in an electronics enclosure (EC).

Solenoid Valve Control Module

The Solenoid Valve Control Module (SVCM) provides pneumatic on/off control for both sampling and oven systems functions. The SVCM manifolds are connected as a group of four 4-way and four 3-way solenoids. The (SVCM) receives commands from the I^2C bus. Solenoid commands are received from the SNE. Solenoid relay status is read back to the SNE to indicate whether a selected solenoid is to be deactivated or activated. Timing is controlled by SNE timing. There is no time base in SVCM.

Commands from I^2C bus control the deactivation or activation of solenoid valves. If fault or warning conditions have occurred, pressure control and SVCM status information is returned to the SNE and SYSCON database.

Columns

The sample is injected by the sample valve(s) into the chromatograph columns where the sample is separated into individual components. Many different types of columns may be used including 1/16-inch micro-packed, 1/8-inch packed and fused silica or metal capillaries. The columns used are dependent on the requirements of the application.

Column Valves

In most applications, there are multiple columns in use that are typically switched by column valves located in between them. These column valves are not shown in the illustration, but like the sample valves described above they are also controlled by the Solenoid Valve Control Module and Sensor Near Electronics Module located in the electronics control section.

Electronic Pressure Control

The carrier gas pressure that is used to push the sample through the columns is controlled by an Electronic Pressure Control Module(s) (EPCM) or in some applications by mechanical regulators. The EPCM is mounted on manifolds located on the EC right-side wall. The pneumatics for the EPCM is digitally controlled by the Sensor Near Electronics (SNE) module. Up to four EPCMs can be mounted in an EC. Each EPCM contains two channels, and each channel can use a different gas at a different pressure. EPCMs are also used to control the fuels for some of the detector modules. Each Electronic Pressure Control Module (EPCM) communicates the actual pressure back to the SNE. Information may then be displayed on the Maintenance Panel.

Oven Heaters

For the columns and detectors to work correctly, they must usually be operated at elevated temperatures. The Maxum II uses electrical heater(s) to elevate the temperature. These heaters (not shown in block diagram) are connected to relays in the Electronic Enclosure section and, like the valves and the Electronic Pressure Control Module(s), are controlled by the Sensor Near Electronics.

Detector

The sample eluted from the columns is transported to the associated detector that senses the presence of the sample and converts it to an electrical signal. Depending upon the application, the Maxum II can include up to three detector modules. Each detector module can have multiple detector sensor elements. Several detector module types are available including Thermistor, Filament, Flame Ionization, Flame Photometric, and Pulsed Discharge.

The resulting electrical signal from the detector is then coupled through the feed-through assembly to the Sensor Near Electronics (SNE) module located in the EC. The detector is assembled as part of the Feed-Through-Module. The Feed-Through-Module electrically connects the oven to the EC and provides electrical safety between the oven and the EC.

Sensor Near Electronics (SNE)

The detector signal(s) is routed to the Detector Personality Module (DPM). The DPM (unique for each detector type) amplifies the analog signal and converts it to a digital signal. The digital signal output from the DPM is processed by the SNE controller (SNECON) software. The DPM is interfaced to installed peripherals connected to the I^2C bus through a set of digital and analog I/O signal commands. All accessible I/O's are uniquely addressable through the module type, enclosure ID, SNE, location ID and module channel number

System Controller (SYSCON)

The System Controller (SYSCON) resides in a pullout drop-down assembly located in the EC and controls all external communications and internal communication to the SNE. The SYSCON houses the primary processor, plug-in I/O boards (for external signal control), communication interfaces, and an interface to the maintenance panel display. All internal communication between SNE and SYSCON is via the internal signal bus.

The original SYSCON consists of a single controller board. The newest version of SYSCON, called SYSCON2, is comprised of a base SIB (SYSCON Interface Board) with an attached CAC3 (Communication and Control board). The SYSCON combines all data results from the SNE and performs additional high level data processing and calculations. The SYSCON connects to a Maintenance Panel display, strip chart recorder, other analyzers, printers, the Advance Communication System (ACS), or other connected networks.

The SYSCON is the analyzer control system in addition to containing the application database. The application database also contains analytical hardware database definitions that are used to perform the following functions:

- Obtain desired sampling measurements
- I/O and SNEs schedule of timing events
- Sequence of sampling streams
- Calculations of calculated values
- Formatting of results and location and outputting results
- How to report or correct error conditions

The SYSCON communicates with the SNE via an internal Ethernet. The SNE communicates with the electronics enclosure (EC) installed modules via the I^2C bus.

Functional Tasks

Overview

This section provides an operational overview of the Real-Time functional tasks of the Maxum II.

- Startup Tasks
  - Applying Power
  - Valid Database
  - Oven Temperature
  - Cycle Control Flag
- Timed Event Scheduling
  - Time-Of-Day Clock
  - Schedule of Events
- Frequency Events
- Analysis Cycle Clock
  - Accessing SYSCON
  - Analysis Cycle Clock
  - SYSCON Cycle Clock
  - Valve Events
- Manual Operations
  - User Interface

Startup Tasks

On start-up, when primary AC power is applied to the analyzer, the analyzer first processes whatever electronic self-tests and diagnostics are required (for example, PROM, RAM, A/D, communication ports, etc.). The processing occurs within 5 seconds.

System related initial messages are generated and output to the network ports. Appropriate initial messages are then displayed on the Maintenance Panel and completed within 20 to 25 seconds. If the analyzer cycle clock is in RUN or CAL mode, an appropriate alarm may be generated during this internal test and the following startup period.

Self Test

After the self-test, the following conditions occur:

- Installed hardware is initialized
- Interrupts enabled
- Oven temperatures and carrier pressure default set points are output
- Analog input system(s), associated with detector inputs, are initialized and begin scanning.

The SYSCON checks to be certain a valid database is resident. If it is, the appropriate temperature and carrier set points are output. If not, default set points are left in place.

Oven Temperature

The oven temperature is monitored to check for being at set point and stable before automatically proceeding. Depending on how long primary AC power has been off, this may take from 2 seconds to 45 minutes.

Cycle Control Flag

A check is made to see if the analyzer is to run a diagnostic type cycle. This is for the purpose of validating the analytical hardware, such as solenoid valves, detectors, carrier regulators, etc. This is optional based on a custom application being initiated per the power fail alarm.

Cycle control flags are checked to see if any analyzer cycle clocks are to be in RUN mode. If they are not, the analyzer remains in the HOLD mode until operator intervention. If the cycle clock is in RUN mode, based on having been in that mode prior to powering down, then that mode should be started in progress without waiting for intervention.

Event Scheduling

The TOD (Time of Day) clock schedules events on a second, minute, hourly, daily or weekly basis. The clock is maintained on the CAC3 board of the SYSCON2 (or on the main control board of the original SYSCON) and schedules events from the residing SYSCON database.

The TOD clock has one-second resolution that is maintained and generated by a hardware device that maintains accurate time independent of analyzer power. This allows a power recovery event to determine duration of power down state.

Certain events are scheduled on a frequency basis, which are independent of the TOD or analysis cycle clocks. The frequency clock has a resolution of 1 second, which is used to schedule repetitive events, such as reading DI and AI signals for alarm purposes. Scheduling of events typically occur at a frequency of every 5 or 10 seconds. They occur regardless of whether the analyzer is in Run or Hold.

Description

A schedule event can be for instrument calibration and special calibrations. Special calibrations include daily or shift averages, report logging to a printer or Host computer. When these tasks are scheduled by TOD clock, they are put on queue. This allows them to be performed at the next appropriate time. Typically, this is after completion of current analysis cycle.

If a calibration is scheduled, it will be put in queue. The calibration is then initiated after completion of current cycle and appropriate time has been allotted for calibration blend to flow through the sampling valve. If shift average reports are to be calculated and printed, the report should include all cycles, which started, or sampled, during the specified shift. To have data available for calculation, a wait period may occur for completion of the current sample analysis.

Analysis Cycle Clock

The Analysis Cycle Clock (ACC) is another clock that provides the time base for all events associated with the actual chromatograph analysis cycle. SYSCON cycle clocks can be configured to provide timed event resolutions of 0.1 second, 0.01 second, 0.01 minute, or 0.001 minute. This is the SNE Event Table Scan Rate, which is independent of detector scan rates.

All SYSCON cycle clocks and associated Sensor Near Electronics (SNE) MUST BE of the same second or minute time units. This clock works in conjunction with the Stream Sequence Table and associated sample stream enable and skip flags. This controls sampling order and analysis of process streams connected to the analyzer.

Accessing SYSCON

The clock cycle RUN mode is controlled by the SYSCON upon command from SNE. When a clock cycle is started, the associated SNEs, for that method, initiate a mirror of the cycle clock.

The SNE clock is the true basis of timed events relating to the Gas Chromatograph oven valve timing, detector digitization and peak integration.

SNE Cycle Clock

The SNE cycle clock is used to schedule the following events.

- Analysis valve timing
- Detector balances
- Temperature set points start and stop for PTGC
- Cycle Reset
- Pressure set point timing for pressure programming
- Analysis result calculations and reporting

Important

Scheduled solenoid valve events cause Solenoid Valve Control Module (SVCM) hardware to be activated within 5 milliseconds of stated cycle time. Any scheduled pressure set point adjustments are transferred to the actual Electronic Pressure Control Module (EPCM) hardware within 5 milliseconds.

Manual Operations

Manually controlled functions can be initiated through the Maintenance Panel. A manual controlled event can occur asynchronously with any event and control some of the analyzer operations. Controlled items include:

- Activation of solenoid valves
- Balancing detectors
- Changing a pressure or temperature set point
- Initiating a calculation
- Report logging event
- Change the cycle time of an event
- Initiate a calibration

Analyzer Internal Communications

Description

Several internal communication links are used to provide the communication paths from the SYSCON to the SNEs and from the SNEs to the SVCM, EPC, PECM and from SYSCON to the I/O bus.

- I^2C Internal Bus
- Support for legacy CAN Internal Bus
- Legacy 10BaseT Internal Bus for SYSCON2 (10Base2 for original SYSCON)

Physical Connections

The Advance Communication System (ACS) Ethernet is accessed via the SYSCON Peripheral Control Interface (PCI) board 10base2 port. The SNEs are accessed internally via the 10baseT internal bus on the SYSCON2 (or the 10Base2 internal bus on the original SYSCON).

10 BaseT Internal Bus

In the SYSCON2, the internal data bus configuration is dependent on the number of installed SNEs, which is, in turn, dependent on the analyzer/data base configuration. This is particular to the number of oven installed detectors being serviced and the detector sampling rates. For most applications, a single SNE is equipped. In this situation, the internal Ethernet port on the SYSCON2 connects directly to the Ethernet port on the SNE. For very complex or high sampling rate configurations, more than one SNE may be equipped. In this case, an Ethernet Switch Board with Fiber (ESBF) module is plugged into a PCI slot of the SYSCON2. The switch then connects to all installed SNEs as shown in Figure 1-5. Note that an ESBF (with Fiber) is required because only this board is capable of plugging into a PCI slot. Note also that the Ethernet Switch Board (ESB) in the network slot should NOT be used because this board must be connected for external Ethernet.

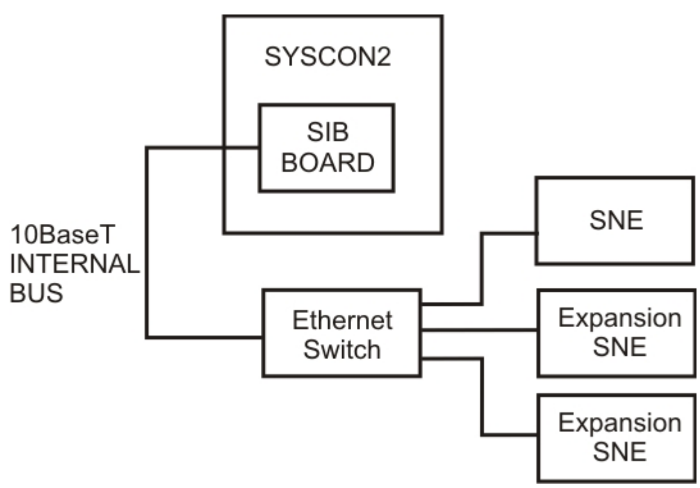


Figure 1-5: Internal Ethernet for SYSCON2 with Multiple SNEs (Single SNE Configurations Cable Directly)

I²C Internal Bus to SNE Detector Interface

The I²C Internal bus is used to interface the detector signal from the Detector Personality Module to the SNE controller board and then to the SYSCON; see Figure 1-6. The Internal bus also interfaces the SNEs associated modules with the SNE; see Figure 1-7.

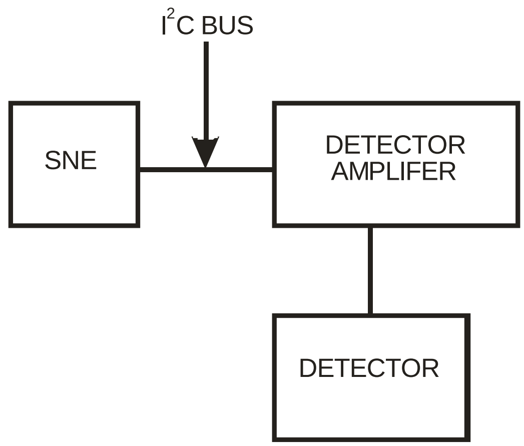


Figure 1-6: I²C Internal to SNE Detectors

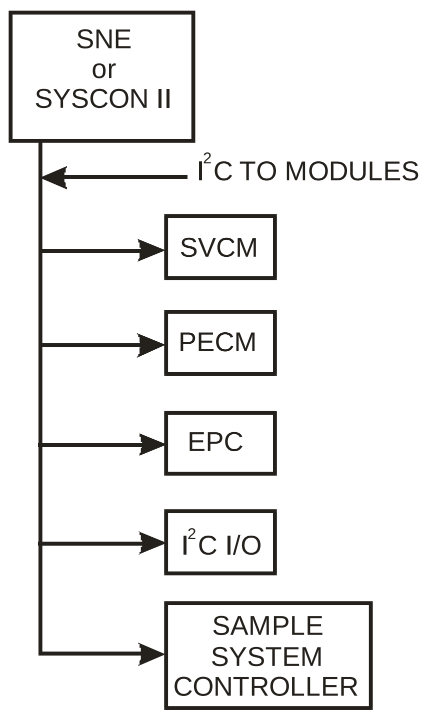


Figure 1-7: I²C Internal Bus to Enclosure Installed Components

CAN Bus

The CAN Bus interfaces the CAN Extension Unit with the SYSCON; see Figure 1-8.

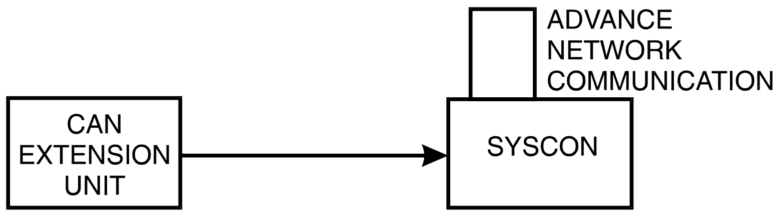


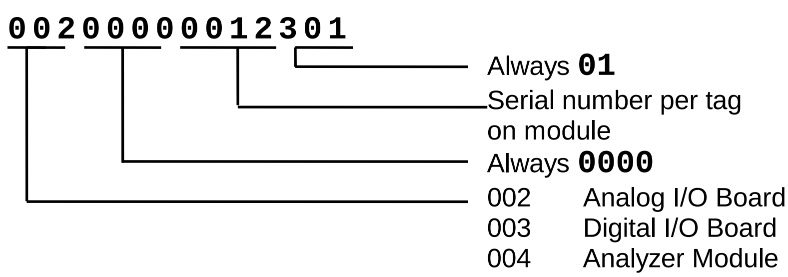
Figure 1-8: CAN Bus

CAN Module Addressing

Installed CAN Modules are identified by physical address which consist of module type, serial number and I/O channel number.

A serial number must be entered when adding or replacing (changing) system modules; see Chapter 3 Maintenance Panel Operation; Setting up CAN I/O modules page 3-142. The serial number is indicated on the module.

The entire 14-digit serial number must be entered (for example):



Maxum II Hardware Identification

Overview

The Maxum II modules located in the electronic enclosure section have their own physical address and communicate via the I^2C Internal Bus; see Figure 1-9. Address information is contained in the SYSCON database and identifies modules by their location.

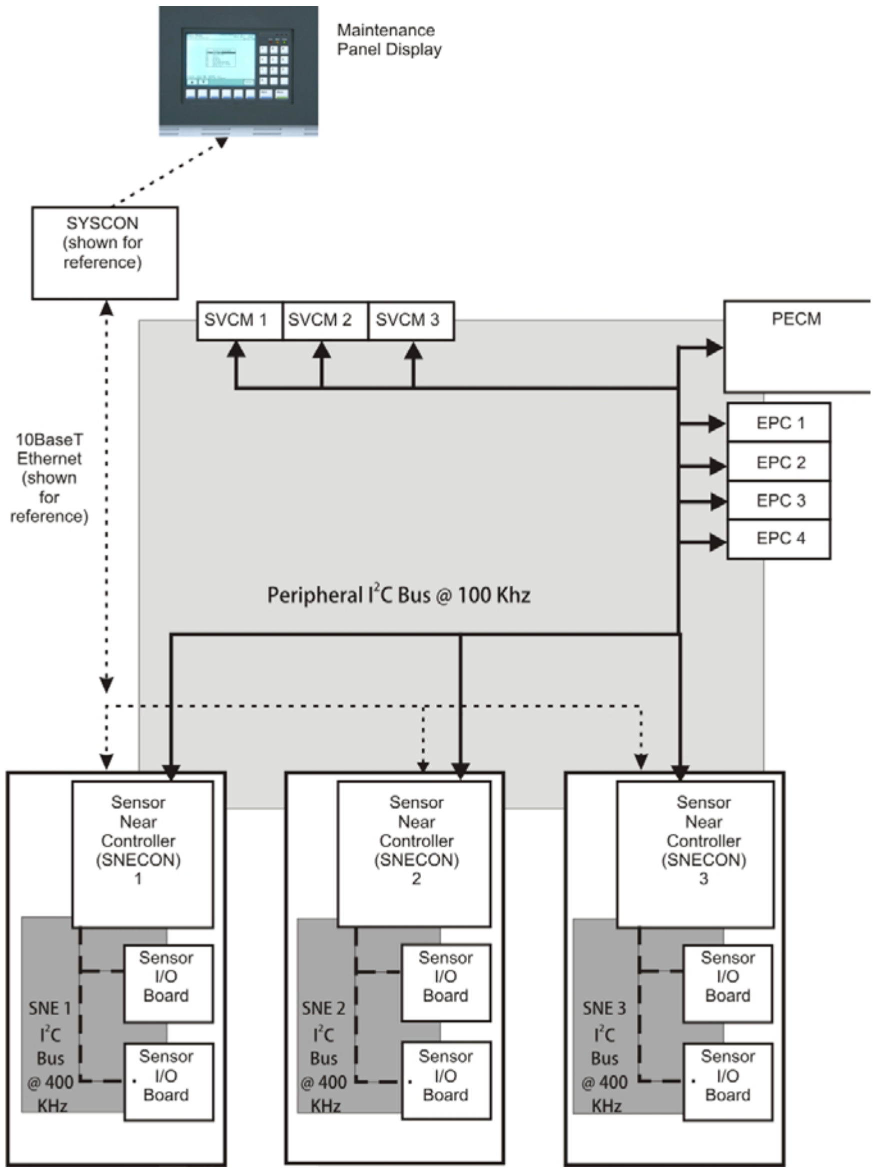
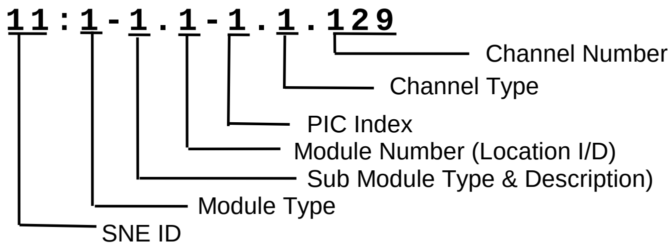


Figure 1-9: I^2C Bus Configuration

Identification Number

ALL modules within the Maxum II electronic enclosure have a unique identification number as related to the Sensor Near Electronics module which controls them. The identification relationship between the SNE and the modules it controls is referred to as the SNE ID String.



Address information is located in the analyzer local I/O Table. The I/O points are identified by module type, mounting location within the electronic enclosure and channel number. This allows module addressing from either the SYSCON database, SNE Tables or from Advance Database.

SNE ID String

One SNE in the enclosure serves as the Bus Manager for the I^2C bus (identifies all installed modules, assigns each module an address and manages communications with the associated module). Each SNECON has only one Bus Manager for its associated module. The SNECON initializes the address to be certain there is no conflict with other Bus manager capable devices

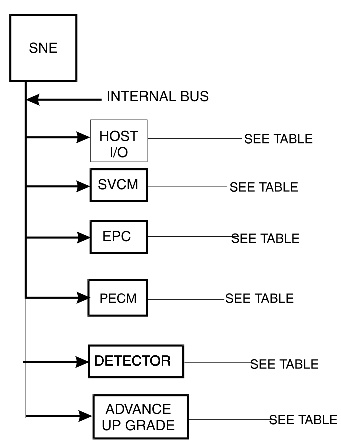


Figure 1-10: SNE ID String

Advance Communication System

Network Connectivity

The Advance Communication System (ACS) uses industry standard protocols and provides high-speed communication among all devices. The ACS can function alone or may be connected to a Distributed Control System (DCS) or plant-wide Local Area Network (LAN). As with other Siemens systems, the network has complete backward compatibility with existing Advance Data Hiway systems.

The network supports the following Advance products (note that some products may be legacy products no longer offered):

Maxum II and Optichrom GCs

- Flexible high speed peer-to-peer communication
- Open TCP/IP connectivity to industry standard networks for large, open systems.
- Single Ethernet or redundant DataNET implement in any combination.
- Interconnection to Advance Data Hiway and Advance Optichrom Chromatographs for backward compatibility.

Network Access Unit

- Maintenance Panel availability
- Remote Maintenance Panel access (optional) to any GC attached to the ACS
- Slots for optional analog and digital I/O boards which can be used by any GC attached to the ACS
- Multiple units can be attached anywhere in one ACS

CAN Extension (CEU)

- Additional I/O board slots allows for expansion of I/O capability

Hub

- Redundant version of ACS

DataNET

- Twisted pair wire or fiber optics
- True message confirmation
- Hazardous area hardware ratings

Advance Network Gateway (ANG)

- Interface high speed Ethernet or DataNET to existing Advance Data Hiway for backwards compatibility

Work Station

- User interface for maintenance
- Programming interface for engineering changes
- Real time network status monitoring

Advance Data Hiway Communications

Description

This section presents information on how the Analyzer communicates with devices on the Advance Data Hiway (ADH) network. Refer to Figure 1-11.

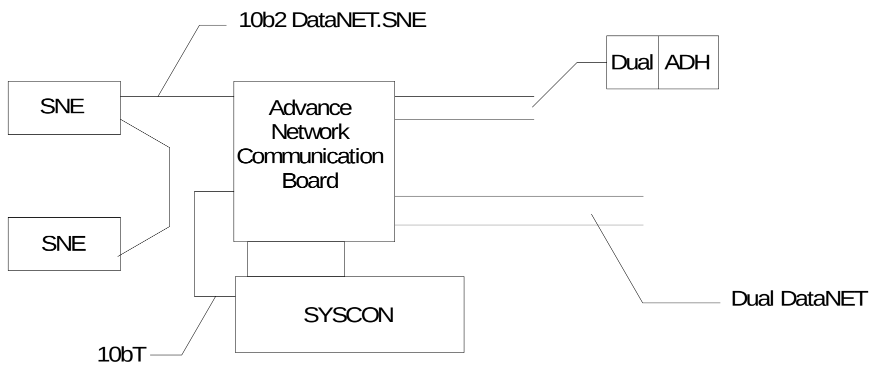


Figure 1-11: ADH Signal Flow Diagram

Powering Up

When analyzer system is powered up, a file is transferred from the SYSCON to the Communication Board Ethernet port and the Loop and Unit address for the ADH ports. This allows the Communication Board to be configured from the SYSCON Application Set information.

Analyzer Message

When the analyzer sends a message to another device connected on the Advance Data Hiway (ADH), the SYSCON formulates the ADH message. It then encapsulates the message as a TCP/IP message on the DataNET with a SYSCON source IP and Communication Board destination IP. The ADH message indicates the preferred ADH channel for transmission. The Communication Board retrieves this message, strips off TCP/IP protocol information, and then transmits the message on the selected ADH channel.

Broadcast Message

For a broadcast message, the SYSCON sends one message to the Communication Board. The channel is set to A and the broadcast bit is set. The Communication Board transmits the broadcast message on both ADH channels.

Another ADH Device

For messages directed to the analyzer, from another installed ADH device, the message will have the destination Loop and Unit address as those of the Communication Board ADH ports. The Communication Board retrieves this message, encapsulates the ADH message in TCP/IP protocol, and then transmits it to the SYSCON with the destination IP.

Receiving Broadcast Signal

When the analyzer receives a broadcast signal on the ADH network, the Communication Board treats it as any other message. Typically the SYSCON receives two messages for each ADH broadcast set. One is from channel A and the other from channel B.

Chapter 2

Maxum II Modules

Overview

Description

This chapter describes each replaceable module installed within the Maxum edition II® Gas Chromatograph (also called Maxum II).

Chapter Highlights

In this Chapter the following information is provided:

New Maxum II Components

Several improvements are incorporated into this new version of the Maxum II. These include:

- New color touchscreen interface
- New system controller (SYSCON 2.1)
- Redesigned PECM with added features
- An Intrinsically-Safe TCD DPM
- A new Base3 DPM
- A Temperature-Control DPM

An Appendix is included at the end of this manual with information on previous components

The SYSCON 2.1 assembly, including the System Interface Board version 3 (SIB3) with the Communication and Control board version 3 (CAC3) module mounted on it, handles the processing and database requirements of the analyzer. It communicates internally via I^2C interface, and externally via an Ethernet port. PCI-bus expansion slots are provided with additional CAN connectors to support legacy I/O boards

The PECM now has 7 I^2C ports, eliminating the need for the Wiring Distribution Board used in previous analyzers.

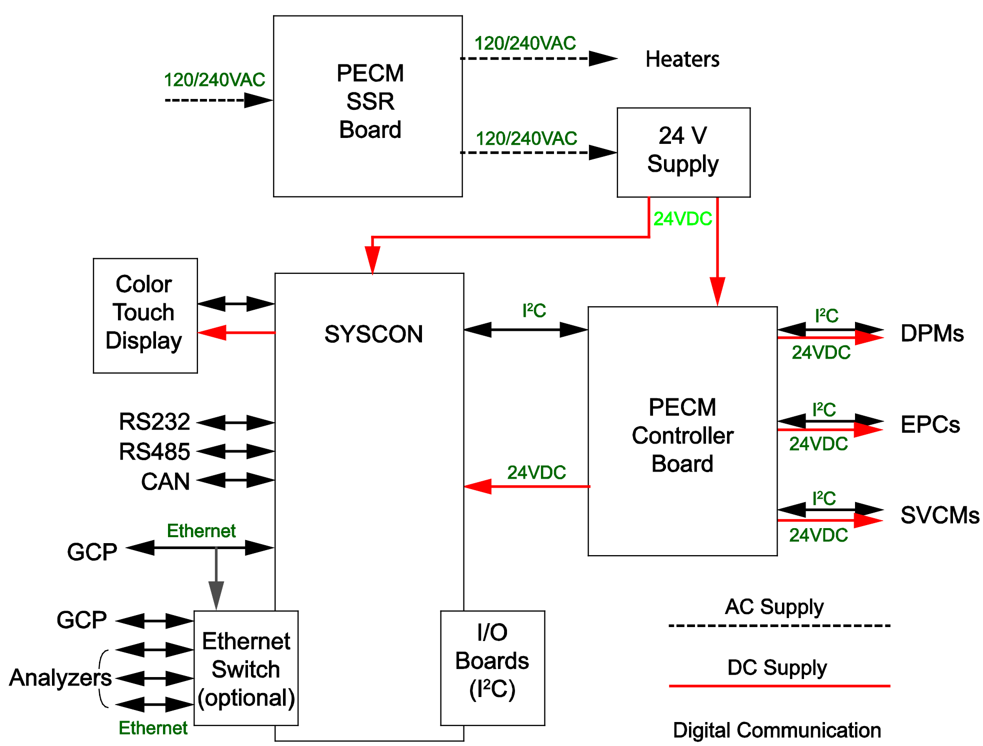


Figure 2-1 Maxum II Power Distribution and Communication Paths

As shown in Figure 2-2, the electronics enclosure (EC) is simplified compared to earlier analyzers. This example shows one DPM; there are three DPM mounting positions available.

Figure 2-2 Maxum II Electronics Enclosure and Color Touchscreen Door

Detector Input Paths

Detectors are connected in three basic ways as sown in Figure 2-20 through Figure 2-21. More information is available in the Base3 Detector Personality Module (DPM) section on page 2-27 and the Intrinsically-Safe Thermal Conductivity DPM (IS-TCD3) section on page 2-32.

Detector Control

Many detectors require various control signals as shown in … For more information see Base3 Detector Personality Module (DPM) on page 2-27.

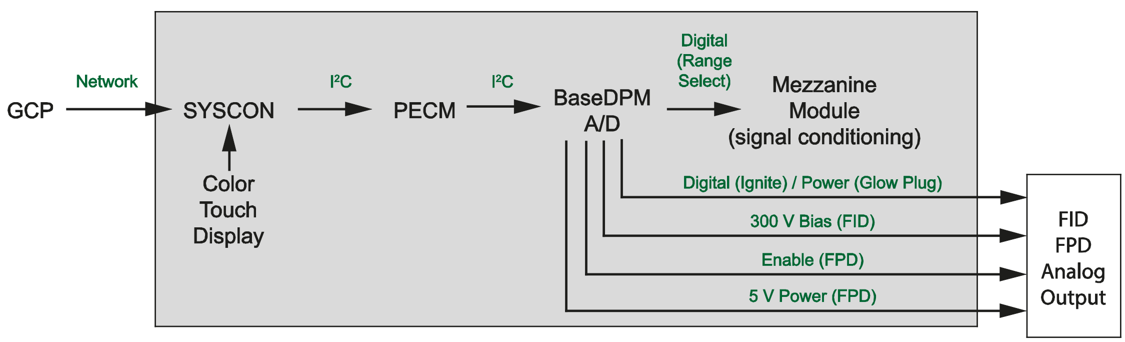


Figure 2-3 Maxum II Detector Control Functions

Heater Control Options

Heaters can be controlled by circuitry on the Base3 and Temperature Control DPMs, or on the PECM. The signal path is shown below:

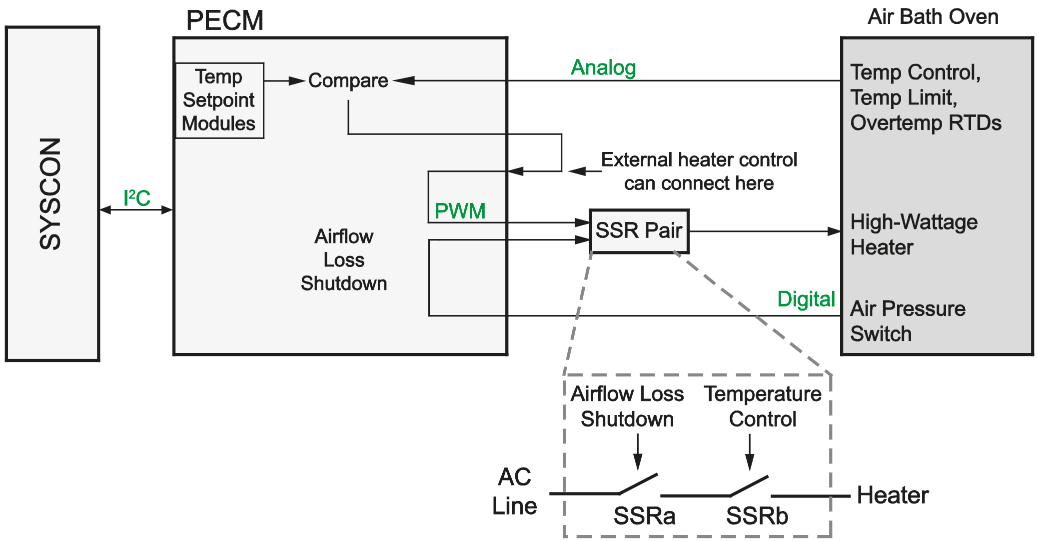


Figure 2-4 Heater Control Loop

System Controller Version 2.1 (SYSCON2.1)

Description

The System Controller (SYSCON2.1) is a combination of two interconnected boards that together function as the control processor and motherboard for the Maxum analyzer.

The SYSCON2.1 consists of two boards, the Communication and Analytical Control (CAC3) board and the SYSCON Interface Board (SIB3). The CAC3 contains the processor and memory functions for the SYSCON2.1 as well as control of external Ethernet communications (via the Ethernet Switch Board). The CAC3 is mounted on and operates in conjunction with the SIB3. With the exception of external Ethernet, the SIB3 contains all interfaces provided by the SYSCON2.1.

The CAC3 on the SYSCON2.1 stores the analyzer application database, combines all data results, and performs additional high-level data processing and calculations. All network communications, maintenance panel and analyzer functions are also coordinated by the SYSCON2.1. The SYSCON2.1 provides communication between the Controller Board, I/O Boards and the EC operating modules.

More information about the SYSCON can be found in the System Controller version 2 (SYSCON2.1) Installation Manual (Siemens part number A5E02643617001).

Part Numbers

The Syscon2.1 cage assembly, part number A5E02599491004, is available in an upgrade kit, part number A5E02599495001.

The SIB3 board part number is A5E31994086001
The CAC3 part number is A5E02599492004

Additional Functions

- Processing and communicating the measurement values
- Controlling system functions, e.g. calibration
- Display and operator control
- Controlling associated systems, e.g. gas supply
- Generating reports

Software Support

The SYSCON2.1 is supported only by software version 5.2 or greater.

Mechanical

The SYSCON2.1 board pair resides in the SYSCON assembly. This assembly is a pullout, drop-down drawer located on a slide rail assembly mounted to the upper wall of the Electronic Enclosure. The SYSCON assembly is a card cage housing the SYSCON2.1 boards, the Ethernet Switch Board, and any other associated hardware such as I/O boards.

The Color Touchscreen cables directly to the SIB3 through an opening in the rear of the SYSCON assembly.

All PC boards in the SYSCON assembly are visible through the front of the drawer for making all I/O connections. Interface connectors to the front panel display, and communication connectors are also located and labeled on the front of the drawer.

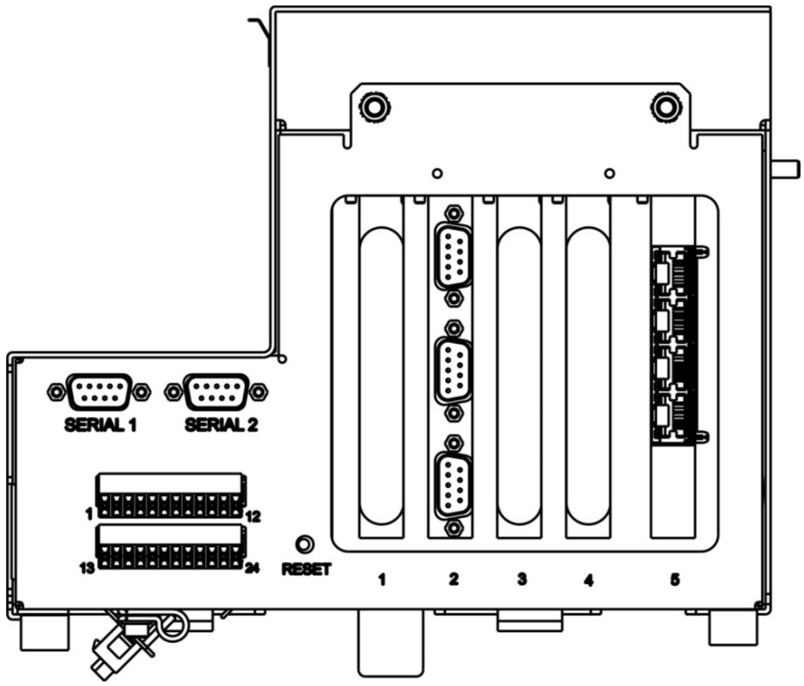


Figure 2-5 SYSCON Assembly for SYSCON2.1

SYSCON2.1 Operation

The SYSCON2.1 performs these functions:

- Contains the application programs and data that are accessible directly or via the external network
- Contains and runs MaxBasic programs
- Controls the Color Touchscreen
- Coordinates all network communications
- Coordinates and runs all analyzer functions

Enhancements of the SYSCON2.1 over the SYSCON2:

- Simpler cabling and cleaner EC interior
- LED backlight power and LCD screen interface to support the new Touchscreen Interface Board (TIB), mounted on the door with the color touchscreen.
- Automatic pullup sensing to eliminate the pullup switches

Enhancements of the SYSCON2 over the SYSCON:

- Superior performance
- Two on-board I^2C buses. This allows the SYSCON2 to support I^2C functions such as sample system control.
- Four serial ports, each configurable for either RS-232 or RS-485 operation.
- Using the Ethernet Switch Board, four Ethernet connections are available. Advantages include allowing a user to connect a local computer for maintenance purposes without disconnecting the analyzer from the network.
- The Ethernet Switch Board with Fiber eliminates the need for a dedicated fiber-optic converter board.

Communication and Control (CAC3) Board

The Communication and Control board (CAC) is a standardized, single-board central processing unit for intended for use in Siemens products. For the Maxum family of products the third generation of the CAC board (CAC3) is used. See Figure 2-6.

The CAC3 includes an on-board 10/100 Ethernet controller, used for connection to external Ethernet. This is connected via a short RJ-45 patch cable to the Ethernet Switch Board, which resides in a card slot on the SIB3.

More information and details pertaining to the CAC3 can be found in the System Controller version 2.1 (SYSCON2.1) Installation Manual (Siemens part number A5E02643617001).

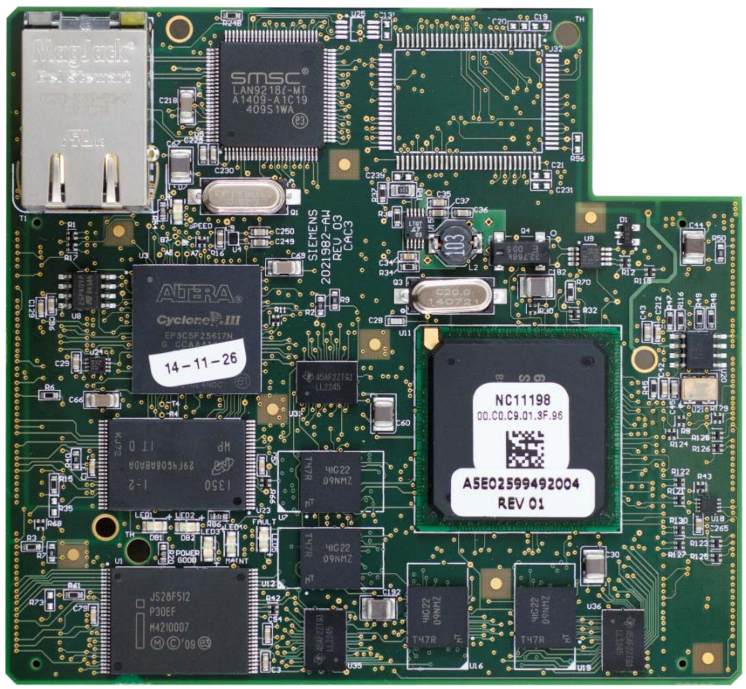


Figure 2-6 CAC3 Board

CAC3 LEDs

The CAC3 is equipped with several LEDs that communicate useful information about the operating status of the CAC3. These LEDs are shown in Figure 2-7 and described in Table 2-1.

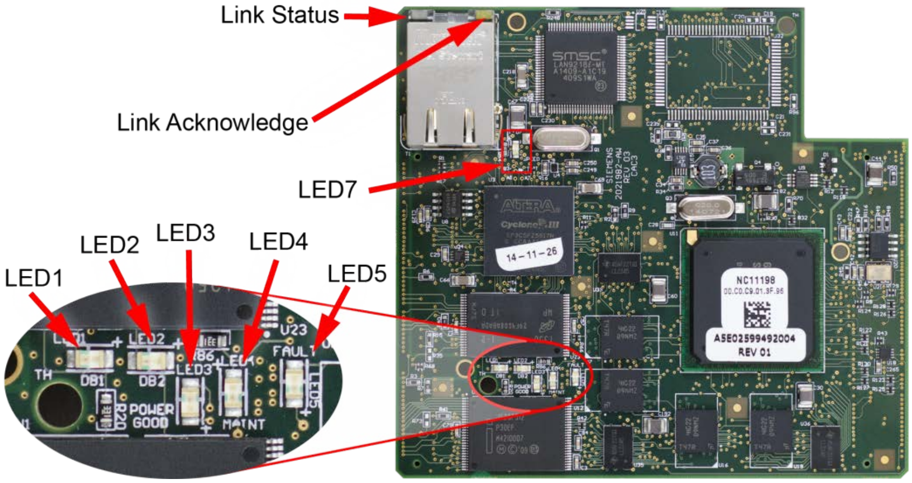


Figure 2-7 LEDs on the CAC3 Board

Table 2-1 CAC3 LEDs

LED1	Debug LED1	Green – On during normal operation.
LED2	Debug LED2	Green – On during normal operation. Off during bootload
LED3	Power Good	Green – Power to CAC3 is functional
LED4	Maintenance	Yellow – Off during normal operation. On during bootload. On – Maintenance fault or bootload
LED5	Fault	Red – CAC3 Board fault
LED7	Ethernet Speed	Green – On – Speed is 100 Mb/sec (or auto-negotiating) Off – Speed is 10 Mb/sec (or disconnected)
Green LED on RJ-45	Link Status	Green – LED is green when link is in full duplex mode.
Yellow LED on RJ-45	Link Acknowledge	Yellow – LED is on when link is active. Will flash off for transmit or receive activity.

SYSCON Interface Board (SIB3)

Compared to earlier Maxum II analyzers, the SIB3/CAC3 together with the Color Touchscreen equipped with a TIB module replaces the SIB2/CAC3 and Color Touchscreen equipped with a CIM module.

The SYSCON Interface Board version 3 (SIB3) is a board that, when combined with the CAC3, creates the function of the SYSCON2.1. Unlike the CAC3, the SIB3 is specific to the Maxum family of products (including the Maxum, the Maxum II, NAU). The combined SIB3 and CAC3 are an electrically and mechanically compatible replacement for the legacy SYSCON board in the Maxum.

Other than external Ethernet, the SIB3 provides all interfaces for the SYSCON2.1. The connections are described below. All connectors in the SYSCON2.1 have the same pin assignments as the corresponding connectors in the original SYSCON, except where noted below. See Figure 2-8 and Figure 2-9 for physical connector locations in the SYSCON2.1:

- **PCI and CAN Direct Slots –** The PCI slots on the SIB3 accommodate a variety of special function cards, including I/O boards or ANCB board. Four PCI slots are equipped in the SYSCON2.1; however, typically only three slots are available for use in the standard configuration, because one SYSCON slot is used for serial/debug port hardware as shown in Figure 2-9.

CAUTION

Only use cards specified and sold by Siemens for the SYSCON2.1. Installation of a card that is not approved by Siemens into a SYSCON2.1 PCI slot, may damage both the card and the SYSCON2.1.

In addition to PCI type cards, the card slots can also accommode Maxum CAN I/O cards. The small green connector in line with the PCI slot allows CAN I/O cards to be installed in the slot. When a CAN card is installed, the green connector provides the power and CAN signals for the card. The PCI slot connector has no electrical connection for CAN cards.

- **Network Expansion Slot –** The Ethernet Switch Board (or Ethernet Switch Board with Fiber) plugs into this connector, located on the far right side of the SYSCON2.1. The connector slot provides power to the Ethernet Switch, but no communication. All communication between the Ethernet Switch and the SYSCON2.1 is through a short CAT5 Ethernet Cable that connects from the CAC3 to the Ethernet Switch.
- **SYSCON Debug –** This serial RS-232 port provides the SYSCON2.1 debug function on the CAC3. The debug port has no support for hardware handshake. The debug port is accessed via a DB9 connector on the front of the SYSCON assembly cage.
- **Serial Ports 1 and 2 –** The SYSCON2.1 is equipped with two serial ports, each ground-isolated and configurable for RS-232 or RS-485. Both ports support RTS/CTS hardware handshake. Maximum supported data rate on the serial ports is 115200 bits/second. Serial Port 1 supports Modbus and Serial Port 2 may be used to support a printer.

Note: When configured for RS-485 operation, the serial ports are designed to comply with the Profibus standard. This results in a different pinout than for the previous version of SYSCON (pins 8 and 2 reversed). For backward Modbus RS-485 compatibility when replacing a SYSCON+ with a SYSCON2.1, an adapter cable (part number A5E02283873001) is available.

DB-9 Pin#	RS-232	RS-485 Modbus
1	-	-
2	RX	5 V Pwr
3	TX	Line B (RxD+/TxD+)
4	-	-
5	GND	Common
6	-	-
7	RTS	-
8	CTS	Line A (RxD–/TxD–)
9	-	-

- **Serial Ports 3 and 4 –** These two serial ports, equipped on the same slot connector as the SYSCON Debug port, are planned for future expansion and are not active in software release 5.0.
- **I^2C Bus –** The I^2C connectors are shown in the upper right corner of Figure 2-8. Two I^2C buses are equipped on the SYSCON2.1. These are labeled I^2C Bus A and I^2C Bus B.
  - **I^2C Bus A** includes the two connectors on the right as shown in Figure 2-8. I^2C Bus A is dedicated and hard wired to the CAN Bridge function. This allows the new SYSCON2.1 to interface with legacy CAN I/O cards in the PCI slots.
  - **I^2C Bus B** includes the three I^2C connectors on the left as shown in Figure 2-8. I^2C Bus B is intended for use to support future configuration changes in the Maxum II.
- **Analog and Digital Inputs/Outputs –** The SYSCON2.1 has ten on-board inputs/outputs. The connectors for these are wired from two orange connectors on the front of the SYSCON assembly cage.
- **Interface to External CAN Bus (for CEU) –** This connector on the SYSCON2.1 is provided to allow support for the CAN Extension Unit (CEU)
- **Internal CAN Bus Interface –** This connector is used for extension of the internal CAN bus to allow for additional CAN I/O cards. It is only used when the SYSCON2.1 is installed in a NAU.

- **Resets –** The SYSCON2.1 is equipped with two connections for SYSCON reset. The first connection, located at the front of the board (bottom of Figure 2-8), is a pushbutton switch. This switch may be accessed via the front of the newest version SYSCON assembly cage as seen in Figure 2-9. The second connection consists of two pin connections at the back of the board (top left of Figure 2-8). This second connection operates using a simple loop closure and is provided to support legacy SYSCON assembly cages that provide a separate wired pushbutton reset. Both connections allow the user to initiate a hard reset of the SYSCON (same as initial power up).
- **Purge –**The purge detect signal is received from the PECM and handled by the SYSCON as a digital input to generate a purge alarm.
- **Interface to display hardware –** The Color Touchscreen connects to the SYSCON2.1 using a physical cable assembly. This cable runs directly from the SIB3 to the Color Touchscreen panel.
- **Power –** The source of power for the SYSCON2.1 is the 24 V power supply equipped in the Maxum analyzer. The SYSCON2.1 is equipped with on-board power conversion to derive the other voltages needed for operation.
- **Battery –** The SYSCON2.1 is equipped with a long-life 3 V battery backup to support the real time clock on the CAC3 board. This battery should last at least 5 years under normal operation. Note that the battery is located on the SIB3 board while the real time clock is on the CAC3 board. If the CAC3 board is disconnected from the SIB3, then battery backup is lost, affecting the time and date on the analyzer.

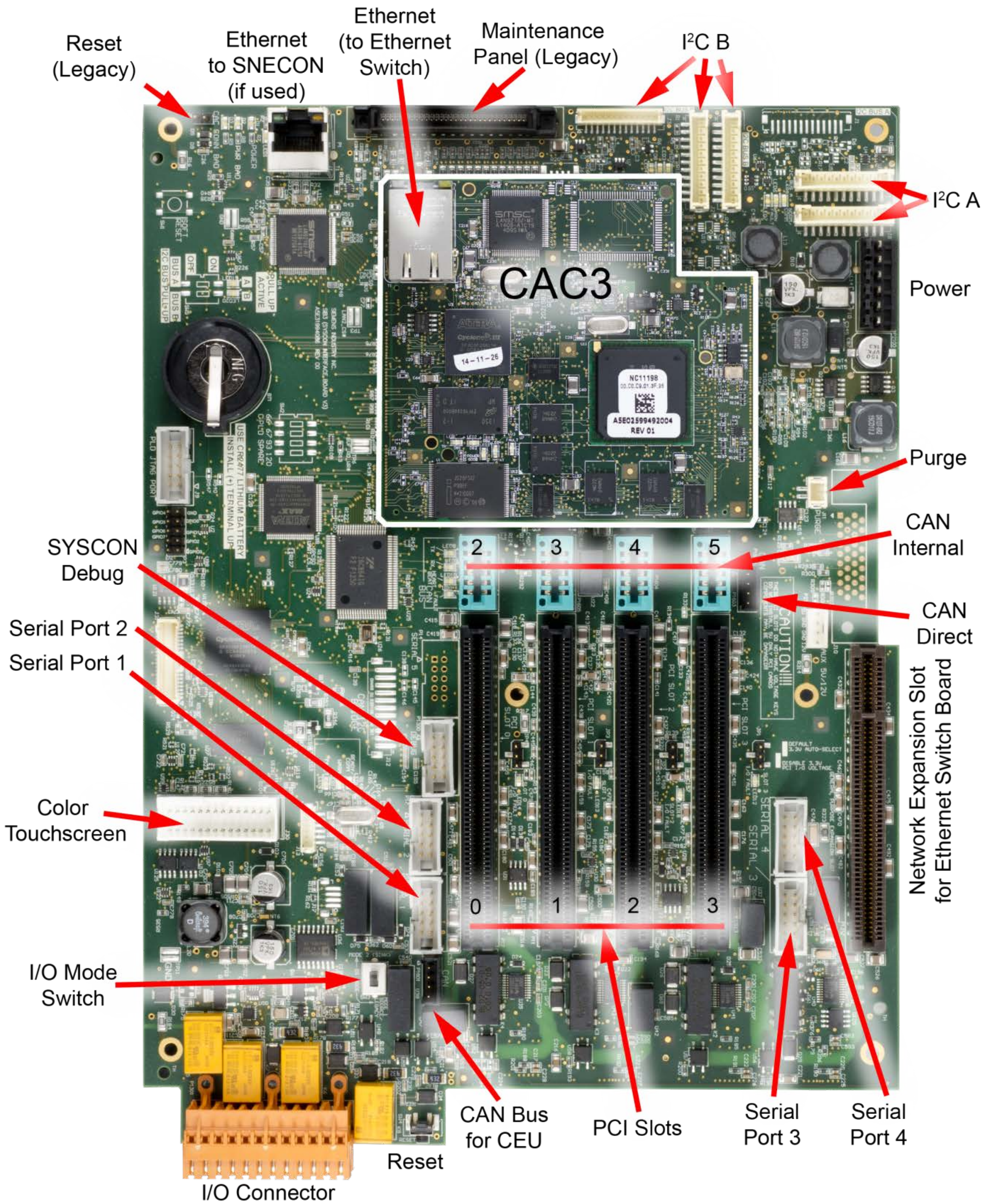


Figure 2-8 SYSCON2.1 Connections

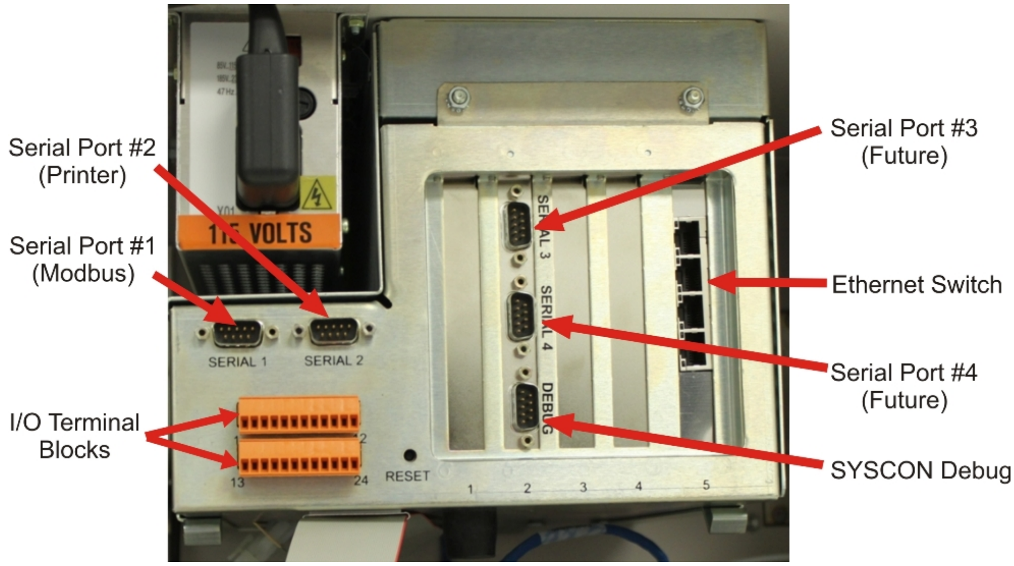


Figure 2-9 SYSCON2.1 Assembly Front Connections

SIB3 LEDs and Options

The SIB3 has several LEDs that indicate useful information about the operating status different interfaces. These LEDs are shown in Figure 2-10 and described in Table 2-2. The SIB3 is also equipped with certain option switches, described below, that must be set correctly for proper operation. Before installation, verify all switch settings. When replacing a SYSCON2.1 verify that the switch settings on the new board match the switch settings on the board being removed.

- **DI Mode Switch –** Switch SW3 located near the orange I/O connectors controls the mode setting for the on-board digital inputs. The available options are Mode 1 (source) and Mode 2 (sink). This switch should be set to Mode 2 regardless of the configuration unless instructed differently by Siemens.
- **Reset Switch –** The function of the reset switch is described in the SIB3 connector description section.

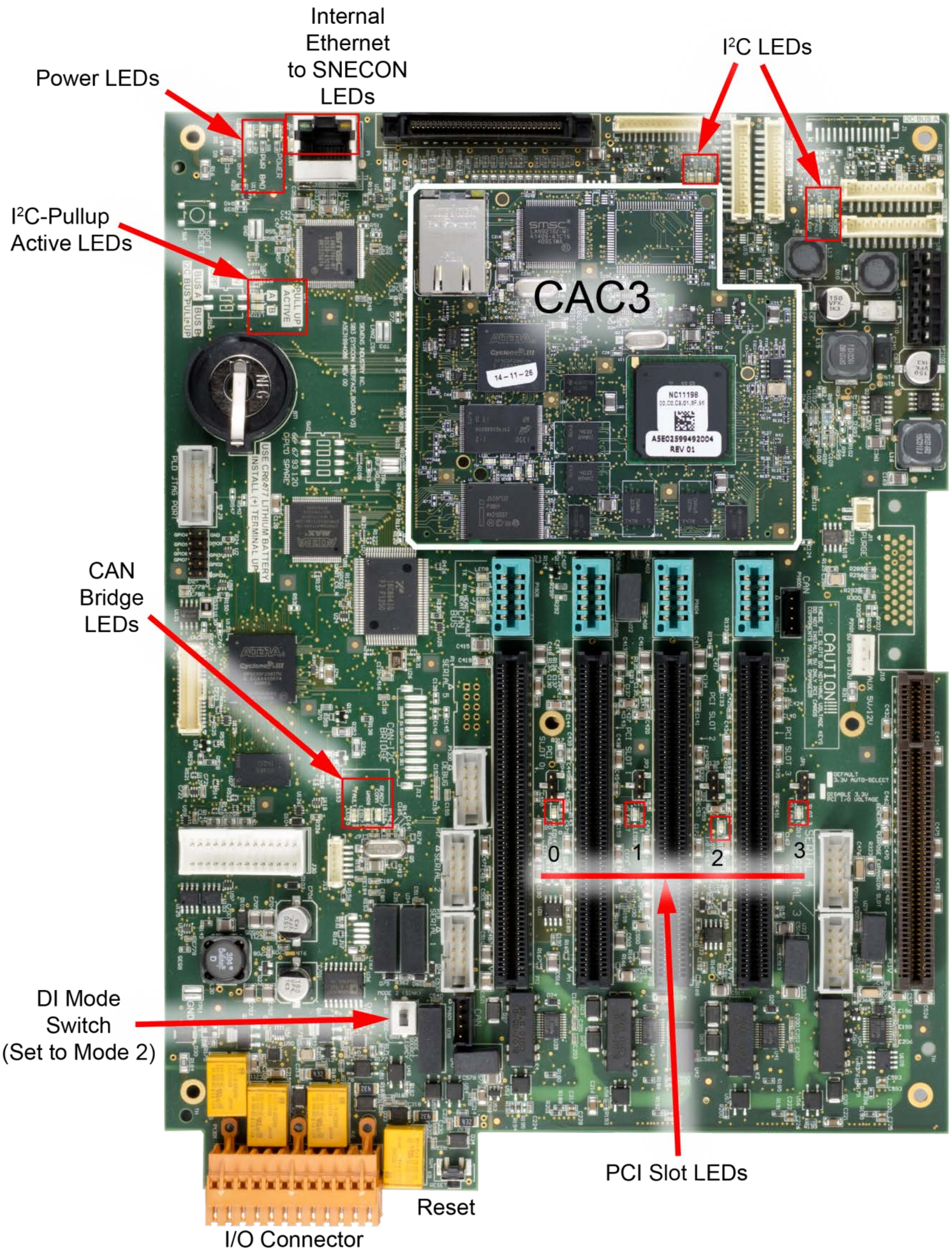


Figure 2-10 SIB3 LED and Switch Locations

Table 2-2
SIB3 LEDs

LED Type	Description	Color / Meaning
Power *(Located at the back of the board near the RJ-45 connector)*	Power	Green – 3.3V power is available. Should be on at all times
	Power Bad	Red – Power is faulty or SYSCON hardware reset switch is being pressed
	CAC Conn Bad	Red – Connection from the SIB3 to the CAC3 is faulty or incomplete. After power up, this LED should turn off once CAC3 to SIB3 connection is completely initialized.
I^2C Bus LEDs Buses A and B *(Located next to I^2C Bus connectors)*	LED2/5 Norm/Comm	Dim Green – I^2C Bus is normal. Bright Green - I^2C Bus is communicating
	LED3/6 Warning	Yellow – Warning on the I^2C Bus
	LED4/7 Fault	Red –I^2C Bus fault
I^2C Bus Pullup-Active LEDs *(Located next to battery holder)*	LED19, 20	The Auto-pullup feature is supplying pullup current on the I^2C bus
CAN Bridge LEDs *(Located to the left of the far left PCI slot)*	LED16 Ready/Comm	Dim Green – CAN Bridge is normal Bright Green – CAN Bridge is communicating
	LED17 Warning	Yellow – Warning on the CAN bridge
	LED15 Fault	Red – CAN Bridge fault
CAN I/O LEDs *(Located next to far left CAN direct connector, CAN direct 5)*	LED8 TX	Green – On when a valid CAN I/O message (other than a heartbeat reply) has been received and queued for processing
	LED9 RX	Green – On when a CAN message (other than a heartbeat transmission) has been queued for sending to the CAN hardware
	LED10 Heartbeat	Green – Flashes once for each heartbeat message transmitted. This LED will flash once every 1.5 seconds for each active CAN card
	LED11 Fault	Red – On when an error state is detected on the CAN bus hardware

<table>
<tr><td rowspan="4">PCI Slot LEDs

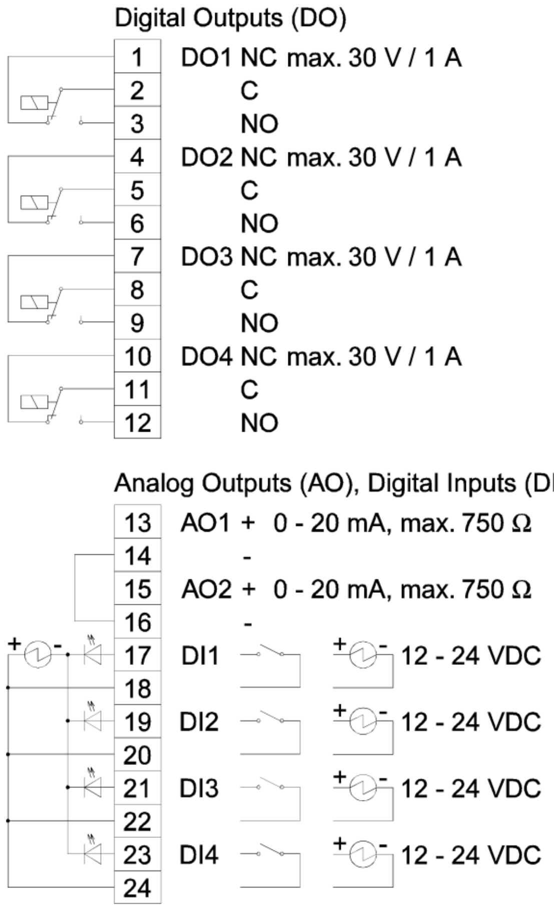
(Located between PCI slots)</td><td>LED14
Slot 0 Fault</td><td>Red – Overcurrent or thermal shutdown on PCI slot 0.</td></tr>
<tr><td>LED13
Slot 1 Fault</td><td>Red – Overcurrent or thermal shutdown on PCI slot 1.</td></tr>
<tr><td>LED18
Slot 2 Fault</td><td>Red – Overcurrent or thermal shutdown on PCI slot 2.</td></tr>
<tr><td>LED12
Slot 3 Fault</td><td>Red – Overcurrent or thermal shutdown on PCI slot 3.</td></tr>
<tr><td rowspan="3">Internal Ethernet LEDs

(located next to and on SIB3 RJ-45 connector)</td><td>Green LED
on RJ-45</td><td>Green – LED is green when link is in full duplex mode.</td></tr>
<tr><td>Yellow LED
on RJ-45</td><td>Yellow – LED is on when link is active. Will flash off for transmit or receive activity.</td></tr>
<tr><td>LED1
Speed</td><td>Green –
On – Speed is 100 Mb/sec
(or auto-negotiating)
Off – Speed is 10 Mb/sec
(or disconnected)</td></tr>
<tr><td colspan="3">Note: Refer to figure 2-20 for physical locations of SIB3 LEDs</td></tr>
</table>

SYSCON I/O Connections

Figure 2-11 shows the on-board SYSCON I/O connections.

The actual pin layout with input and output signals in a delivered system will be shown in the System Documentation package.



DO1–DO4
4 digital outputs: floating double-throw contacts, max. contact load rating 30 V/ 1 A. DO1 is not administrable and is dedicated to "Maxum Fault" (active when the Maxum has an active alarm).

AO1–AO2
2 analog outputs: 0/4–20 mA, common negative pole, galvanically separated from ground, freely connectable to ground, max. gain vs. local protective ground potential 50 V, max. working resistance 750 Ω

DI1–DI4
4 digital inputs: Optocoupler with internal 12–24 VDC power supply, switchable with floating contacts; alternative: switchable with external 12–24 VDC supply, common negative pole

Design: Two 12-pin terminal strips for braided or solid cable with maximum cross-section of 1.5 mm^2 or 16 AWG.

Figure 2-11 System Controller Connection Diagram -X04, -X05

Analog & Digital I/O Boards

The I/O board options for the SYSCON2.1 are the same as for the original version of SYSCON and are described in the previous section. See the section “Analog and Digital I/O Boards” under the original SYSCON section and refer back to “System Controller Connections”, Figure 2-8 through Figure 2-10 and Table 2-1 through Table 2-3 for connection diagrams.

The SYSCON2.1 supports up to two I/O boards, either I^2C or CAN. In preexisting applications needing more than two I/O boards, a legacy CAN Extension Unit (CEU) may have been installed. This device allows up to 10 additional I/O boards. The CEU, if used, connects to the Maxum II Gas Chromatograph via a Serial Link (CAN Bus).

I^2C I/O boards provide approximately twice the number of circuits as previous CAN I/O boards. If an application needs more than two I^2C I/O boards, a Network Access Unit (NAU) can be installed. This allows installation of additional I^2C I/O boards that the Maxum II can access remotely.

I/O Slot Assignments

If expansion boards are added to the SIB3 of the SYSCON2.1, they must be installed in the following slots. These slots are numbered from left to right when viewing the SYSCON2.1 from the front.

- Advance Network Communication Board (ANCB) for Advance Data Highway (ADH) – Slot 1
- No board is installed in slot 2. This slot provides the connectors for external debugging and for serial ports 3 and 4.
- Analog and Digital I/O boards (CAN or I^2C)– Slots 1, 3, or 4 (only 2 may be used at a time)
- Ethernet Switch Board (ESB) or Ethernet Switch Board with Fiber (ESBF) for external Ethernet – Slot 5

All network communications, Maintenance Panel and analyzer functions are coordinated by the SYSCON2.1. The SYSCON2.1 does not control sample analysis performed by the Sensor-Near Electronic Module (SNE). The SNE manages and performs all analysis functions independently of the SYSCON.

Ethernet Switch Board (ESB)

The primary external communication for the SYSCON2.1 is via Ethernet connection. The CAC3 has an on board 10/100 Ethernet port. This is connected via a short RJ-45 patch cable to the Ethernet Switch Board (ESB) that resides on the SIB3. The ESB converts the single CAC3 Ethernet into four Ethernet connections. This allows the SYSCON2.1 to remain connected to an external network while, at the same time, allowing a laptop to be temporarily connected for maintenance and troubleshooting purposes. The remaining connections provided by the ESB are available to connect to other Maxum network options, such as an ANCB installed in the SYSCON chassis or an external connection to a Siemens redundant network interface. The ESB (or ESBF) is required when a SYSCON2.1 is installed in the Maxum.

The ports on the ESB are auto-negotiating for either 10Base or 100Base operation. The Ethernet Switch is plug-and-play as it does not require initial setup or configuration. Configuration of the ESB is not supported at this time.

The ESB is equipped with a jumper setting, R2, located in the lower right portion of the board. For proper field operation this jumper should be set to default position, 2-3 (or the jumper can be removed for default operation as well). There are several LEDs equipped on the Ethernet Switch. These identify the operating speed of each port as indicated in the following table.

Table 2-3
ESB LEDs

LED	Meaning	Meaning/Designation
1	On=100Mb Off=10Mb	Internal RJ-45 Connector to CAC3.
2*	On=100Mb Off=10Mb	External Top RJ-45 Connector
3*	On=100Mb Off=10Mb	External Second RJ-45 Connector
4*	On=100Mb Off=10Mb	External Third RJ-45 Connector
5*	On=100Mb Off=10Mb	External Bottom RJ-45 Connector
*Note: LEDs for external connectors count from the bottom up (e.g. bottom LED is for top connector).		

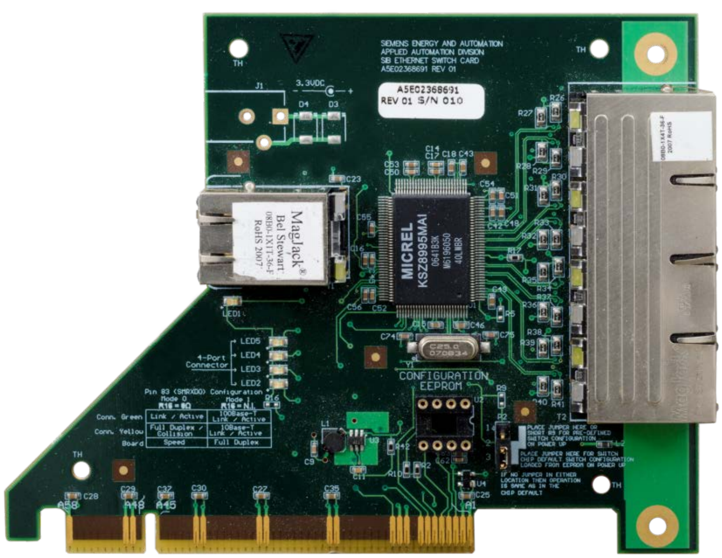


Figure 2-12 Ethernet Switch Board (ESB) Part Number A5E02368691001

Ethernet Switch Board with Fiber (ESBF)

The Ethernet Switch Board with Fiber (ESBF) is similar to the Ethernet Switch Board (ESB) described previously. The primary difference is that for the ESBF one of the 10/100Base-T connectors has been replaced with a 100Base-FX 1300 nm fiber optic connection with duplex ST® connectors. This fiber connection is not compatible with 10 megabit fiber systems.

As can be seen in Figure 2-22 on the following page, the ESBF is equipped with two edge connectors, one on the top of the board and one on the bottom. The board is designed in this manner to support its use in either the network slot (slot 5) of a SYSCON2.1 or in a PCI slot of a SYSCON2.1 or legacy SYSCON1. The slot edge connectors are labeled on the board as “SYSCON2.1 NETWORK SLOT” and “SYSCON/PCI SLOT”. Only one Ethernet Switch may be used in an analyzer.

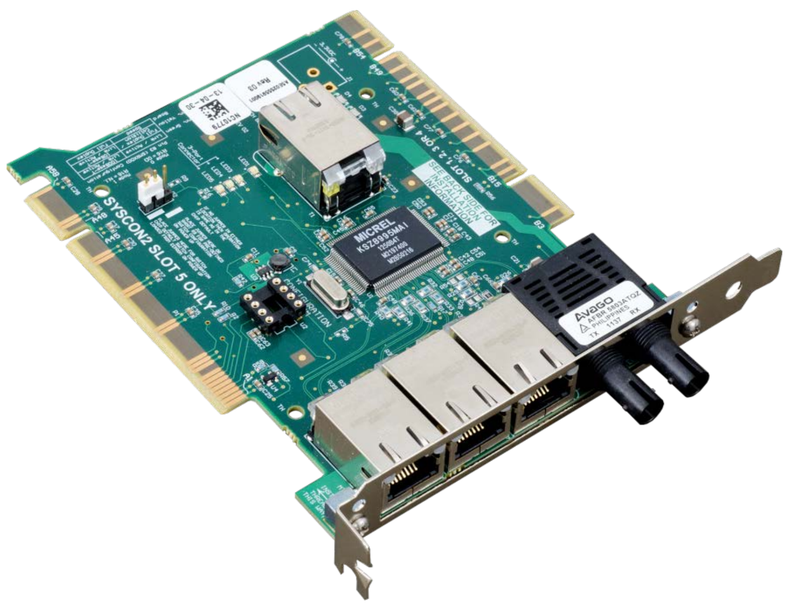


Figure 2-13 Ethernet Switch Board with Fiber (ESBF) Part Number A5E02555919001

Multiple Mode Use of ESBF

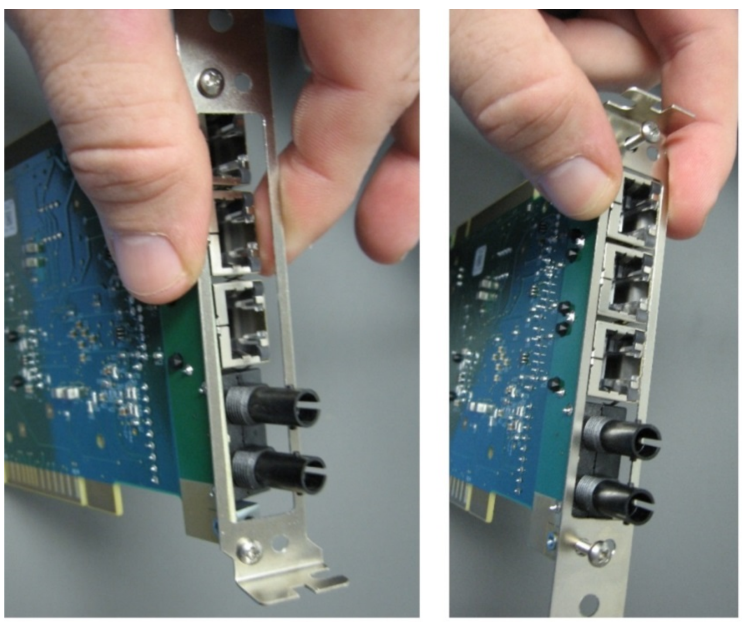
The unique dual edge connector allows the ESBF to be used in both the SYSCON2.1 and legacy SYSCON. The ESBF may be installed in the following configurations:

- Default – In the default configuration, the ESBF installs in the network slot of the SYSCON2.1 (far right slot 5). In this configuration the slot edge connector labeled “SYSCON2.1 NETWORK SLOT” is used (the fiber optic connection is on the top in this configuration).
- SYSCON2.1 Expansion – ESBF is capable of installing in one of the PCI slots (slots 1 through 4, counting from left) of the SYSCON2.1. This configuration is used in the SYSCON2.1 when communicating with more than one SNE or when additional Ethernet communication ports are required. In this configuration the ESBF is turned “upside-down” and the “SYSCON/PCI SLOT”

slot edge connector is used (the fiber optic connection is on the bottom in this configuration).

- SYSCON1 Enhancement – ESBF installs in an empty PCI slot (slots 1 through 4, counting from left). This allows the original SYSCON1 to communicate to more than one Ethernet device at the same time (such as communication to a local laptop computer while still connected to the network). This also allows for easy configuration to support fiber Ethernet connection.
  In this configuration the ESBF is turned “upside-down” and the “SYSCON/PCI SLOT” slot edge connector is used (the fiber optic connection is on the bottom in this configuration).

To support the dual edge connector configuration, the ESBF is equipped with a special reversible bracket. This bracket is detached and turned upside down when the board is installed upside down in a PCI slot. To reverse the bracket, unscrew it and turn it upside down. Then, connect the bracket using the **opposite** set of holes to align the bracket appropriately.



Default Bracket Configuration
Slot 5 on SYSCON2 (Network Slot)

Alternate Bracket Configuration
PCI Slots 1-4 on all SYSCONs

Figure 2-14 Reversing the ESBF Bracket

Analog & Digital I/O Boards – I^2C bus

The newest version of I/O board connects to an I^2C bus. The I^2C I/O boards are the version generally available for new installation. See System Controller Connections, Tables 2-1 through 2-3, for connection diagrams information.

- Analog I/O board (AIO_I^2C, Part Number A5E02486267001): has 8 analog output channels, 8 analog input channels, and 2 digital input channels
- Digital I/O board (DIO_I^2C, Part Number A5E02486268001): has 8 digital outputs and 6 digital inputs
- Analog and Digital I/O board (ADIO_I^2C, Part Number A5E02359491001): has 4 digital outputs, 4 digital inputs, 4 analog outputs, and 4 analog inputs

The DOs are rated for 1A resistive load. Inductive loads are different. A DO should not drive an inductive load greater than 0.5A. An example is the typical block-and-bleed application which uses two parallel solenoids at 0.4A each. Separate DOs should be used to drive each solenoid. Each DO connected to a solenoid should have a diode to suppress the solenoid load.

Additional I/O Boards

The SYSCON supports up to two I^2C I/O boards. These boards provide approximately twice the number of circuits as previous CAN I/O boards. However, if an application needs more than two I/O boards, a NAU can be installed. This allows installation of additional I^2C I/O boards that the Maxum II can access remotely.

I^2C I/O Board DI Mode Switch

For the I^2C I/O boards that contain digital inputs (DIs) switch SW1 located at the top of the board near the front (connector end) controls the mode setting for the on-board DIs. (See Figure 2-15). The switch sets the mode for all DI circuits on the board (mixing of modes on a board is not allowed). The available options are Default/Sink and Legacy (see back side of board for diagram of setting). The Legacy option is designed to adjust for a non-standard configuration that may be in use on some systems. The Mode switch should be set to Mode 2 unless instructed differently by Siemens.

I^2C I/O Board Status LEDs

Three status LEDs have been included on each I^2C I/O board. These LEDs are visible on the top front of the board. The LEDs follow the Maxum standard as follows:

- LED3 (Norm) - The top (green) LED indicates that the board is powered when lit. When this is the only LED illuminated, then the board is operating normally.
- LED2 (Warn) - When lit, the middle (yellow) LED indicates that there is a warning status for the board.
- LED1 (Fault) - When lit, the bottom (red) LED indicates that the board has a fault.

I²C Bus Connections on I²C I/O Boards

There are two standard I²C bus connections on the top of each I²C I/O board. Either of these connections may be used as either a bus input or bus extension connection. In this manner the I2C bus can daisy-chain from one board to another or to other I²C devices.

I²C I/O Board Address DIP Switches

The I²C I/O boards use an 8-bit board identification number as an address on the I²C bus. The address is a hex number from 00 to FF, corresponding to a decimal number from 0 to 255. Address numbers from 1 to 254 are used (numbers 0 and 255 are reserved).

DIP switches are used to set the address for the physical board as shown in Figure 2-15. When replacing a board, the user only needs to set the switches on the new board to match the old board being replaced.

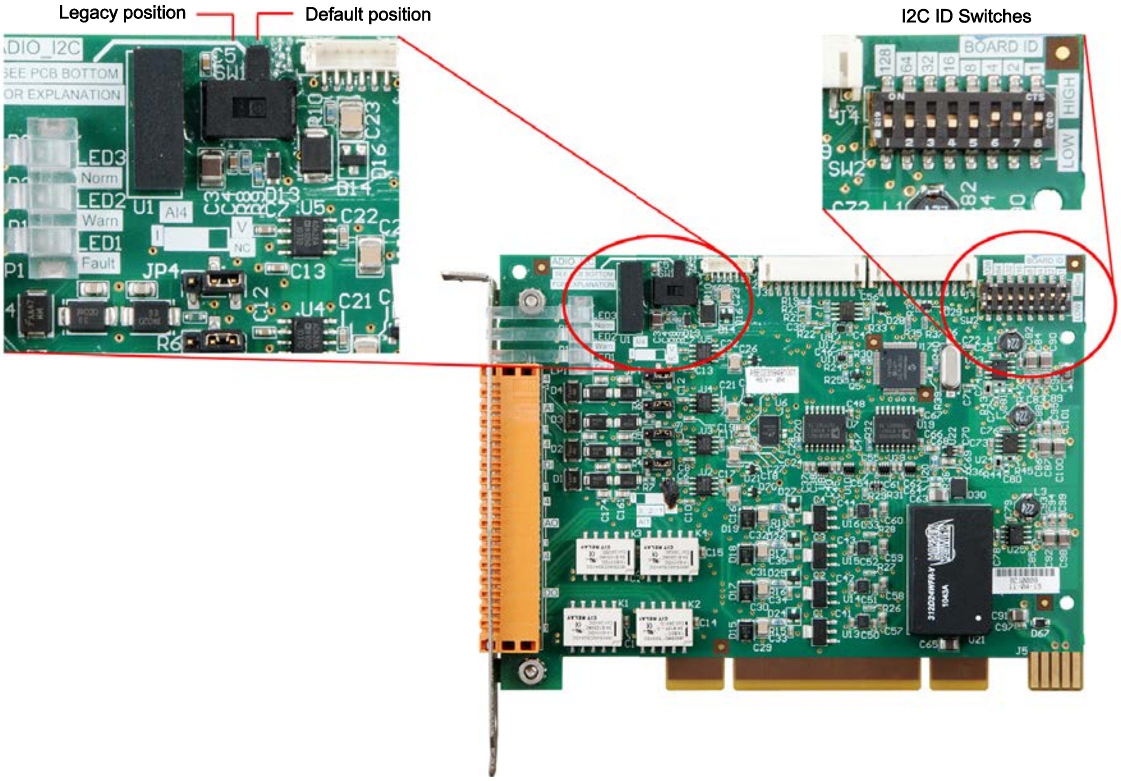


Figure 2-15 I²C I/O Address Switches

The DIP switches used to set the address are on the top back part of the board and are labeled BOARD ID. Together, the DIP switches correspond to an 8 bit binary number that is set to match the board address. Each switch is labeled for the binary digit it represents, and setting a switch is equivalent to setting that bit to 1. For example, if the switches for 1, 2, and 4 are set, then the board ID would be 1+2+4 = 7.

Analog I/O Board (AIO) Connections

Circuits on the AIO board are wired as shown in the following table. The table is the view is as seen when looking at the connector while the board is installed.

AIO I²C Wire Side View					
Lead	**Pin**			**Pin**	**Lead**
AI8 -10V	2	∎	∎	1	AI8 +10V
AI7 -10V	4	∎	∎	3	AI7 +10V
AI6 -10V	6	∎	∎	5	AI6 +10V
AI5 -10V	8	∎	∎	7	AI5 +10V
AI4 -10V	10	∎	∎	9	AI4 +10V
AI3 -10V	12	∎	∎	11	AI3 +10V
AI2 -10V	14	∎	∎	13	AI2 +10V
AI1 -10V	16	∎	∎	15	AI1 +10V
AO_GND	18	∎	∎	17	AO8 Current
AO_GND	20	∎	∎	19	AO7 Current
AO_GND	22	∎	∎	21	AO6 Current
AO_GND	24	∎	∎	23	AO5 Current
AO_GND	26	∎	∎	25	AO4 Current
AO_GND	28	∎	∎	27	AO3 Current
AO_GND	30	∎	∎	29	AO2 Current
AO_GND	32	∎	∎	31	AO1 Current
DI Common	34	∎	∎	33	DI2 Signal
DI Common	36	∎	∎	35	DI1 Signal

Analog Inputs: -20 to +20 mA into 50 ohms or -10 to +10V, R_{10}=1 M-ohm, mutually isolated 10 V

Analog Outputs: 0/4-20 mA. Common negative pole, galvanically separated from ground, freely connectable to ground, max. gain vs. local protective ground potential 50B, max. working resistance 750 ohms.

Digital Inputs: Optocoupler with internal 12-24 VDC power supply, switchable with floating contacts; alternative: switchable with external voltage 12-24 VDC, common negative pole.

Design: Terminal strips for braided or solid conductors with a maximum diameter of 1.5 mm or 16 AWG.

Figure 2-16 I²C AIO Board Connection Diagram -X10 - -X11

Digital I/O Board (DIO) Connections

Circuits on the DIO board are wired as shown in the following table. The table is the view is as seen when looking at the connector while the board is installed.

DIO I2C Wire Side View					
Lead	**Pin**			**Pin**	**Lead**
DI Common	2	∎	∎	1	DI6 Signal
DI Common	4	∎	∎	3	DI5 Signal
DI Common	6	∎	∎	5	DI4 Signal
DI Common	8	∎	∎	7	DI3 Signal
DI Common	10	∎	∎	9	DI2 Signal
DI Common	12	∎	∎	11	DI1 Signal
DO8 C	14	∎	∎	13	DO8 NC
DO7 NC	16	∎	∎	15	DO8 NO
DO7 NO	18	∎	∎	17	DO7 C
DO6 C	20	∎	∎	19	DO6 NC
DO5 NC	22	∎	∎	21	DO6 NO
DO5 NO	24	∎	∎	23	DO5 C
DO4 C	26	∎	∎	25	DO4 NC
DO3 NC	28	∎	∎	27	DO4 NO
DO3 NO	30	∎	∎	29	DO3 C
DO2 C	32	∎	∎	31	DO2 NC
DO1 NC	34	∎	∎	33	DO2 NO
DO1 NO	36	∎	∎	35	DO1 C

Digital Inputs: Optocoupler with internal 12-24 VDC power supply, switchable with floating contacts; alternative: switchable with external voltage 12-24 VDC, common negative pole.

Digital Outputs: Digital Outputs: Floating double-throw contacts, max. contact load rating 30 V/1A

The DOs are rated for 1A resistive load. Inductive loads are different. A DO should not drive an inductive load greater than 0.5A. The typical block and bleed application, which uses two parallel solenoids at 0.4A each, should use separate DOs to drive each solenoid. Each DO connected to a solenoid should have a diode to suppress the solenoid load.

Design: Terminal strips for braided or solid conductors with a maximum diameter of 1.5 mm or 16 AWG.

Figure 2-17 I²C DIO Board Connection Diagram -X10 - -X11

Analog and Digital I/O Board (ADIO)

Circuits on the ADIO board are wired as shown in the following table. The table is the view is as seen when looking at the connector while the board is installed.

ADIO I²C Wire Side View					
Lead	**Pin**			**Pin**	**Lead**
AI4 -10V	2	▪	▪	1	AI4 +10V
AI3 -10V	4	▪	▪	3	AI3 +10V
AI2 -10V	6	▪	▪	5	AI2 +10V
AI1 -10V	8	▪	▪	7	AI1 +10V
DI Common	10	▪	▪	9	DI4 Signal
DI Common	12	▪	▪	11	DI3 Signal
DI Common	14	▪	▪	13	DI2 Signal
DI Common	16	▪	▪	15	DI1 Signal
AO_GND	18	▪	▪	17	AO4 Current
AO_GND	20	▪	▪	19	AO3 Current
AO_GND	22	▪	▪	21	AO2 Current
AO_GND	24	▪	▪	23	AO1 Current
DO4 C	26	▪	▪	25	DO4 NC
DO3 NC	28	▪	▪	27	DO4 NO
DO3 NO	30	▪	▪	29	DO3 C
DO2 C	32	▪	▪	31	DO2 NC
DO1 NC	34	▪	▪	33	DO2 NO
DO1 NO	36	▪	▪	35	DO1 C

Analog Inputs: -20 to +20 mA into 50Ω or -10 to +10V, R_{10}=1 MΩ, mutually isolated 10 V

Analog Outputs: 0/4-20 mA. Common negative pole, galvanically separated from ground, freely connectable to ground, max. gain vs. local protective ground potential 50B, max. working resistance 750 ohms.

Digital Inputs: Optocoupler with internal 12-24 VDC power supply, switchable with floating contacts; alternative: switchable with external voltage 12-24 VDC, common negative pole.

Digital Outputs: Digital Outputs: Floating double-throw contacts, max. contact load rating 30 V/1A

Design: Terminal strips for braided or solid conductors with a maximum diameter of 1.5 mm or 16 AWG.

Figure 2-18 I²C ADIO Board Connection Diagram -X10 - -X11

Base3 Detector Personality Module (DPM)

Description

Output signals from any of the detectors connect to each associated Detector Personality Module (DPM) input. The transfer of detector data is based on the database method. The DPM digitizes the signal and then passes the data to the SYSCON via an I^2C port. Results can then be viewed on the Color Touchscreen or the workstation. See Figure 2-19.

The method is the part of the application that contains the parameters for controlling the hardware used by one cycle clock. It provides peak areas and component concentrations and includes all cycle clock timed events. There is one cycle clock per method.

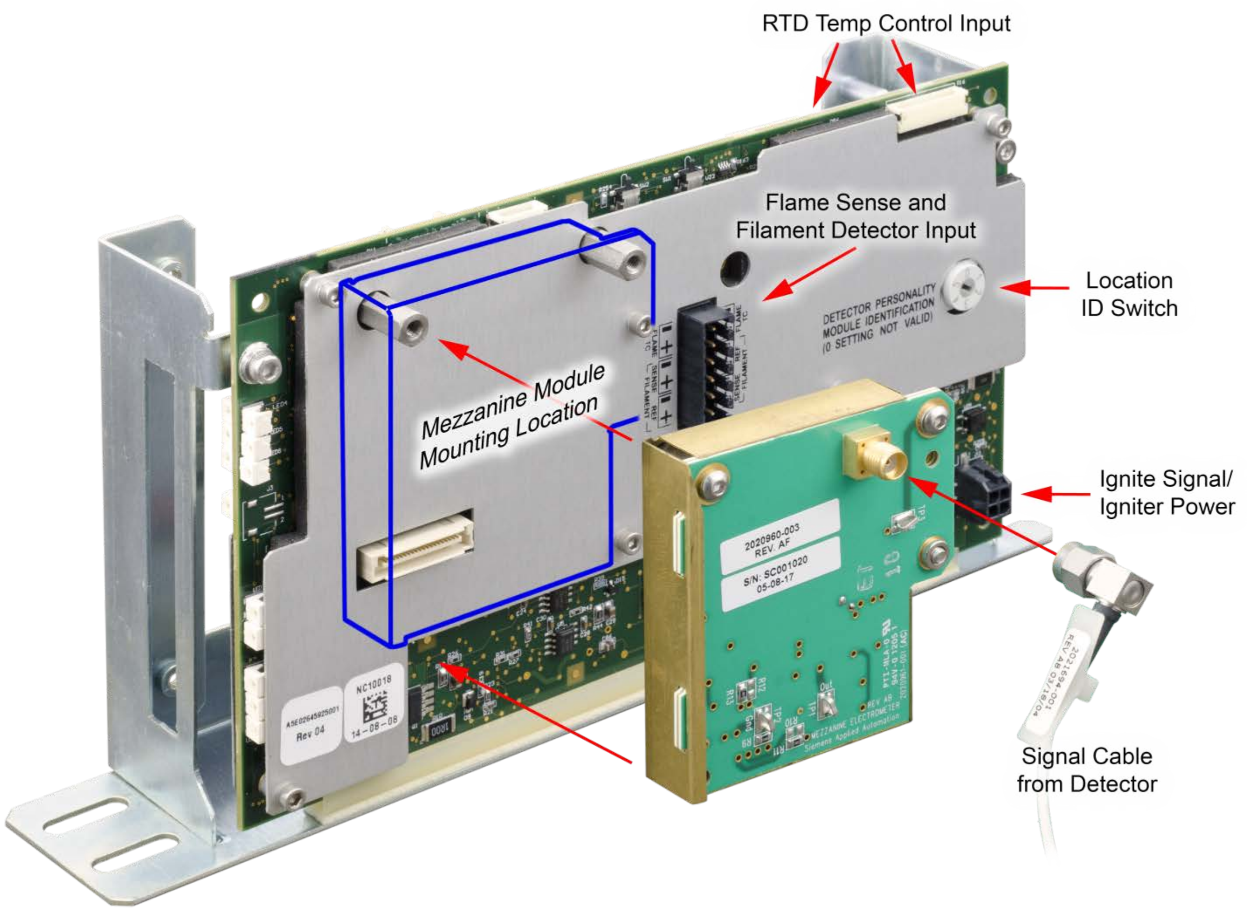


Figure 2-19 Base3 DPM With Mezzanine Module

Part Number

The Base3 DPM (Part Number A5E02645925001) is shipped with current analyzers. It can be used as a replacement part for earlier DPMs in Maxum I analyzers using an adapter, part number A5E34938458001.

Overview of DPM Functions

The Base 3 Detector Personality Module (DPM) combines these functions in a single module:

Including Mezzanine Module	FID	Input from detector via mezzanine module
		Ignite signal / glow-plug output
		Range-select output
		300-V bias output
		Flame-sense input (used in Maxum I analyzers only)
	FPD	Input from detector via mezzanine module
		Ignite signal / glow-plug output
		Range-select output
		Enable signal output
		300-V bias output
		Flame-sense input (used in Maxum I analyzers only)
	Analog voltage input	Input from detector via mezzanine module
		Range-select output
Filament Detector		Input via connector on right side (as viewed inside analyzer EC)
Temperature control		Temperature setpoint module connector
		Two RTD inputs
		Two heater-control outputs
System communication		I^2C port with ID-select switch

Input Signal Paths

The input-signal functions are shown in Figure 2-20 and Figure 2-21.

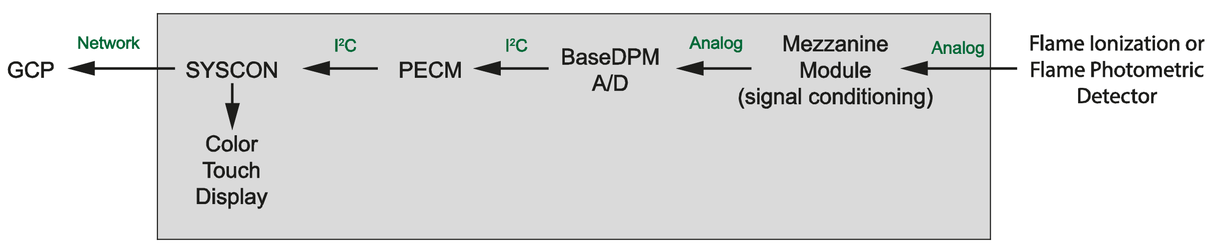


Figure 2-20 FID, FPD, or Analog Input Detector Input Signal Path

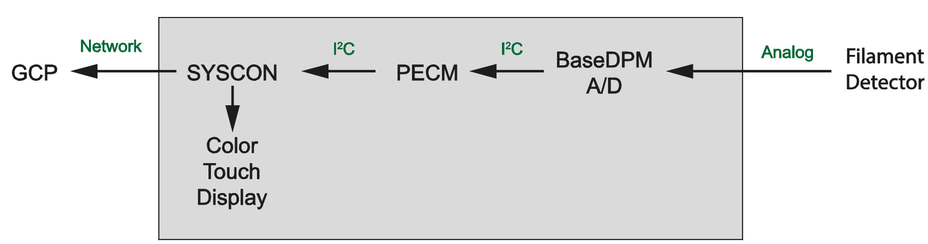


Figure 2-21 Filament Detector Input Signal Path

Detector Control Paths

Several control signals are available to control various detector functions as shown in Figure 2-22.

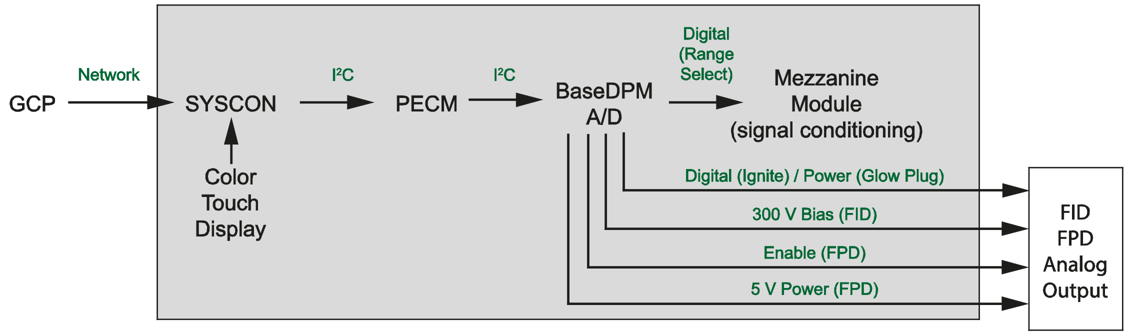


Figure 2-22 Maxum II Detector Control Functions

Location ID Switch

The Location ID Switch, shown in Figure 2-19, selects the DPM location that is incorporated in the address, to be reported in the results.

The DPM I^2C port is connected directly to the system controller via the PECM or a wiring distribution board. In this scenario, the following values are applied:

Switch Value	Location
1	Left
2	Center
3	Right

NOTE: If the DPM I^2C port is connected to an SNE, the value is always set to “1”. The actual location value is determined by the SNE.

DPM-Based Temperature Control

The Base3 DPM has two temperature-control channels. Two RTD inputs feed two comparator circuits to drive two heater-control outputs. The heater-control outputs connect to inputs on the PECM in most analyzers. The control path is shown in .

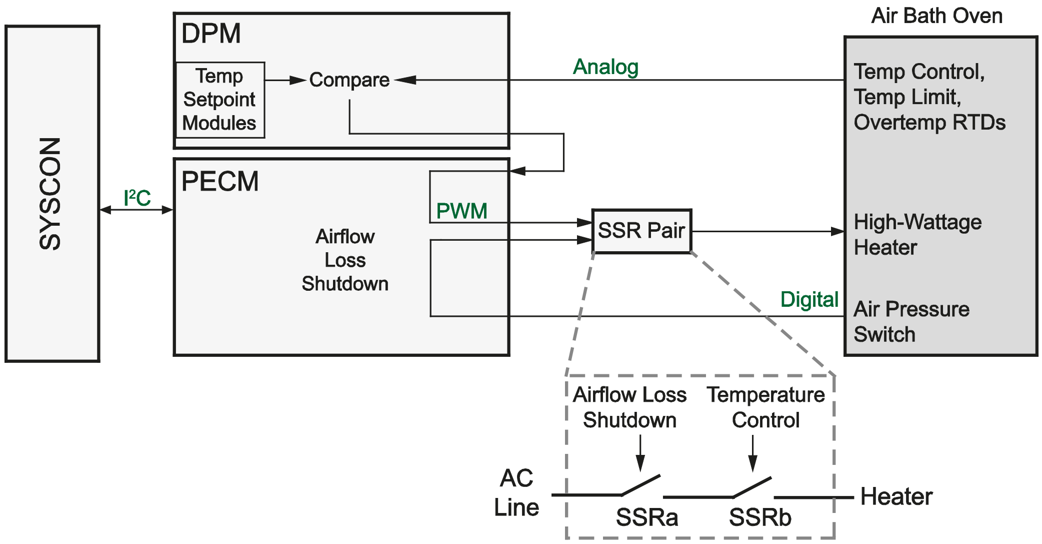


Figure 2-23 Heater Control Path Using DPM

A mounting location and connector are provided for two Temperature Setpoint Modules. The modules are installed on the left side (back) of the DPM, shown in Figure 2-24. This same position is used in the *Temperature Control DPM*.

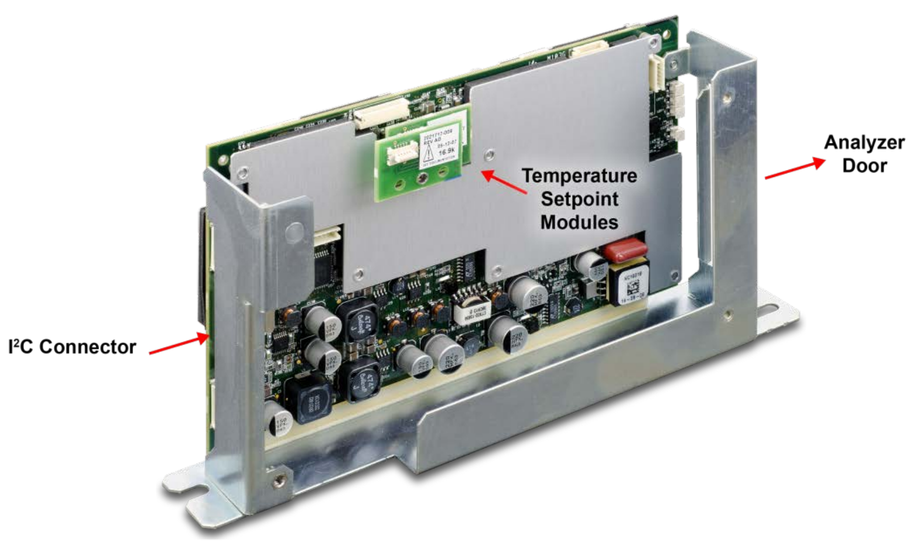


Figure 2-24 Temperature Setpoint Modules Installed on Left Side of Base3 DPM

Mezzanine Modules

A mezzanine module conditions the signal from a non-conductivity detector. The mezzanine plugs into the Base3 DPM in order to tailor the DPM for a specific measurement.

Three primary types of mezzanine are available to accommodate FID and FPD detectors, and various detectors that produce a scaled analog output (AI) mezzanine. Some of the mezzanines have a dual range function for maximum flexibility. See Table 2-4 below for details relating to the various mezzanine options.

The AI mezzanine can be used for reading a detector voltage signal from a specialized or third party detector, such as the Valco PDD, where the device only supplies a scaled voltage output. The AI signal will be treated like a normal detector signal, with a 50% balance range.

Table 2-4 Mezzanine Part Number Descriptions

Mezzanine	Detector Sub Module Type	Usage	Normal Range	Alternate Range
2020960-001	FID	Low level FID	0.2nA	none
2020960-003	FID	Standard FID	1nA	20nA
2021328-002	FID	Large Scale FID	100nA	1000nA
2021328-001	FPD	FPD	100nA	none
2021328-003	FPD	FPD 0.18 Hz Filter	100nA	none
2021326-001	UNIVersal	Voltage AI	+/-1V	+/-10V
1901614-001 Dummy Plug	UNIVersal	When Base DPM is Filament only, and no mezzanine required	none	none

Intrinsically-Safe Thermal Conductivity DPM (IS-TCD3)

Overview

Output signals from Thermal Conductivity Detector (TCD) in the Modular Oven are input to the associated Detector Personality Module (DPM). The DPM is mounted inside the Electronics Enclosure (EC) on the floor of the compartment. The DPM digitizes the incoming analog signal and then passes the data to the SYSCON via an I^{2}C port. The resulting data is then processed by the Embedded SNE software. Results can then be viewed on the maintenance panel or the workstation. See Figure 2-25.

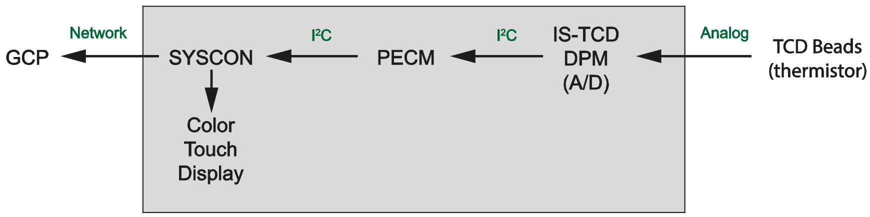


Figure 2-25 Thermal Conductivity Detector Signal Path

The IS-TCD3 DPM is an enclosed unit that is not field repairable. Opening the case may violate the safety protection of the device. Service is limited to replacement of the entire DPM.

Part Number

The IS-TCD3 DPM (part number A5E02645923001) is shipped with current analyzers. It can be used as a replacement part for earlier DPMs in Maxum I analyzers using an adapter, part number A5E34938550001.

Intrinsic Safety

The intrinsic safety feature of this module is only used in the Maxum II Modular Oven. The following two paragraphs apply only if this feature are used.

The TCD DPM in the Maxum II, as well as the actual detector controlled by the TCD, is protected by intrinsic safety. Intrinsic safety is a method of protection where a circuit is designed such that it will not create a spark or other condition capable of causing ignition of flammable vapors or gases, even under fault conditions. Various circuits in the Maxum analyzer use this form of protection, including the IS-TCD3.

CAUTION

⚠

To preserve the intrinsically safe design protection of the IS-TCD3, certain measures are required. Failure to adhere to all requirements for use of the IS-TCD3 in the Maxum II could violate the safety protections of the analyzer. See the *Maxum II Explosion Protection Safety Standards Manual* (A5E02220442001) for more information on the safe use of intrinsically safe circuitry in the Maxum II.

Connections

The connections to the IS-TCD3 DPM are shown in figure 2-13 below. The connections are described below.

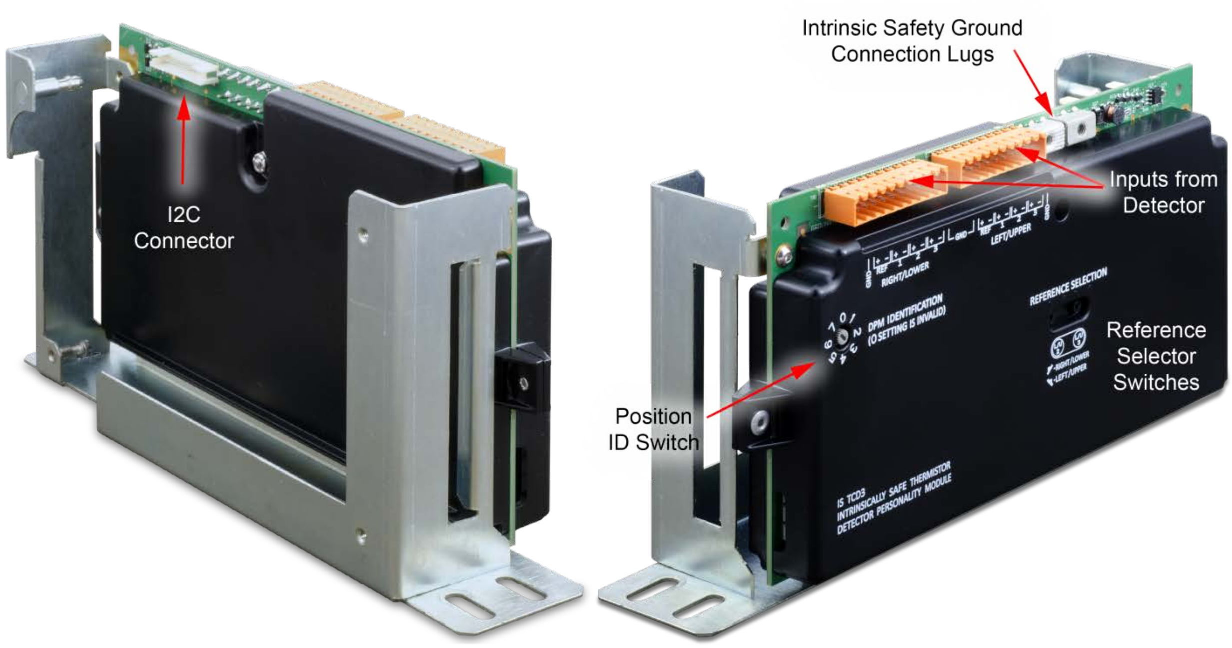


Figure 2-26 IS-TCD3 DPM Connector Locations

Orange connectors to detectors: Each IS-TCD3 DPM consists of two connections. Each connection is capable of interfacing to two pairs of TCD elements (four total channels, 1 for reference and 3 for signal).

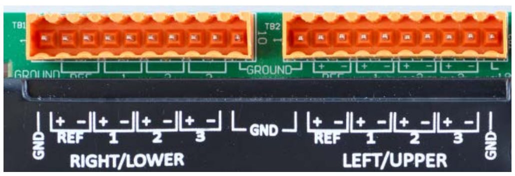


Figure 2-27 Detail of Detector Connectors

Intrinsic Safety Grounds: The intrinsically safe design of the IS-TCD3 DPM (not normally used with airless or airbath ovens) requires two ground connections to the chassis terminated to two different terminals. The Maxum II Modular Oven is shipped with these grounds connected correctly. Refer to the Maxum II Explosion Protection Safety Standards Manual (A5E02220442001) for more information on the safe use of intrinsically safe circuitry in the Maxum II.

I^2C Bus Connection: The white connector on the reverse side of the DPM connects to the I^2C Bus on the PECM as shown in Figure 2-25.

Switch Settings

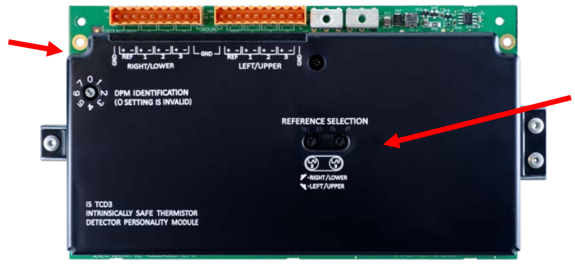


Figure 2-28 IS-TCD3 DPM Switches

Temperature Control DPM

Overview

The Temperature Control DPM is identical to the Base3 DPM except that it includes only the temperature-control components. This is useful when extra temperature-control functions are needed.

A Location ID Switch is also included, and functions as described in *Location ID Switch.*

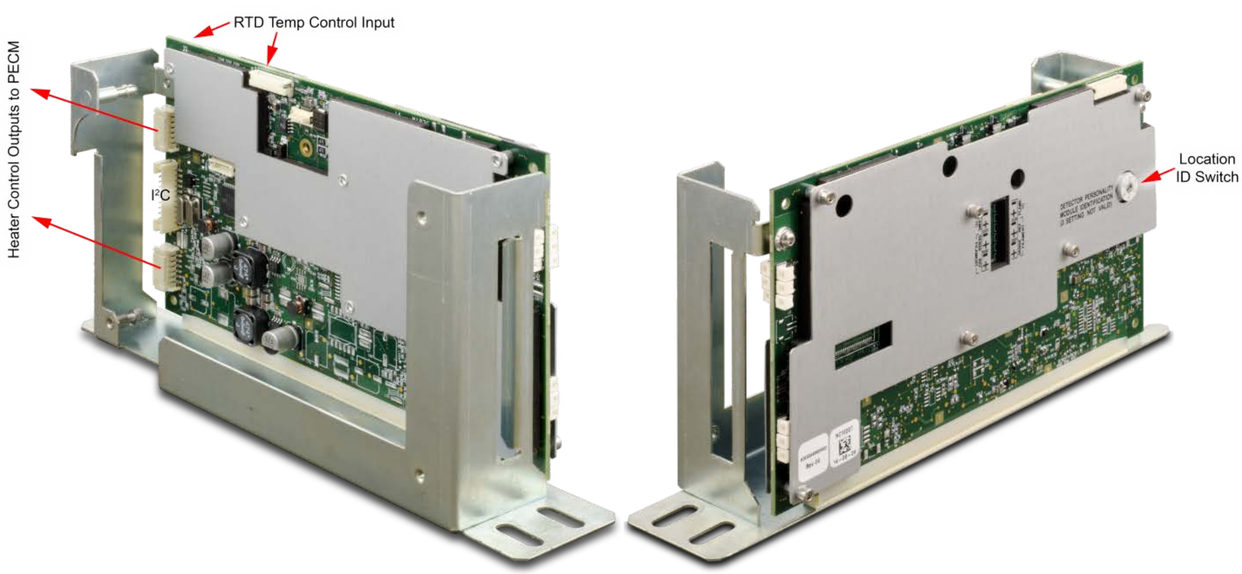


Figure 2-29 Temperature Control DPM Connections

Part Number

The Temperature Control DPM (Part Number A5E02645925002) is shipped with current analyzers. It can be used as a replacement part for earlier DPMs in Maxum I analyzers using an adapter, part number A5E34938458001.

PECM Assembly

Overview

The PECM3-CTL board mounts on the PECM-SSR board. This assembly provides a variety of power and control functions. The connections are shown in Figure 2-30.

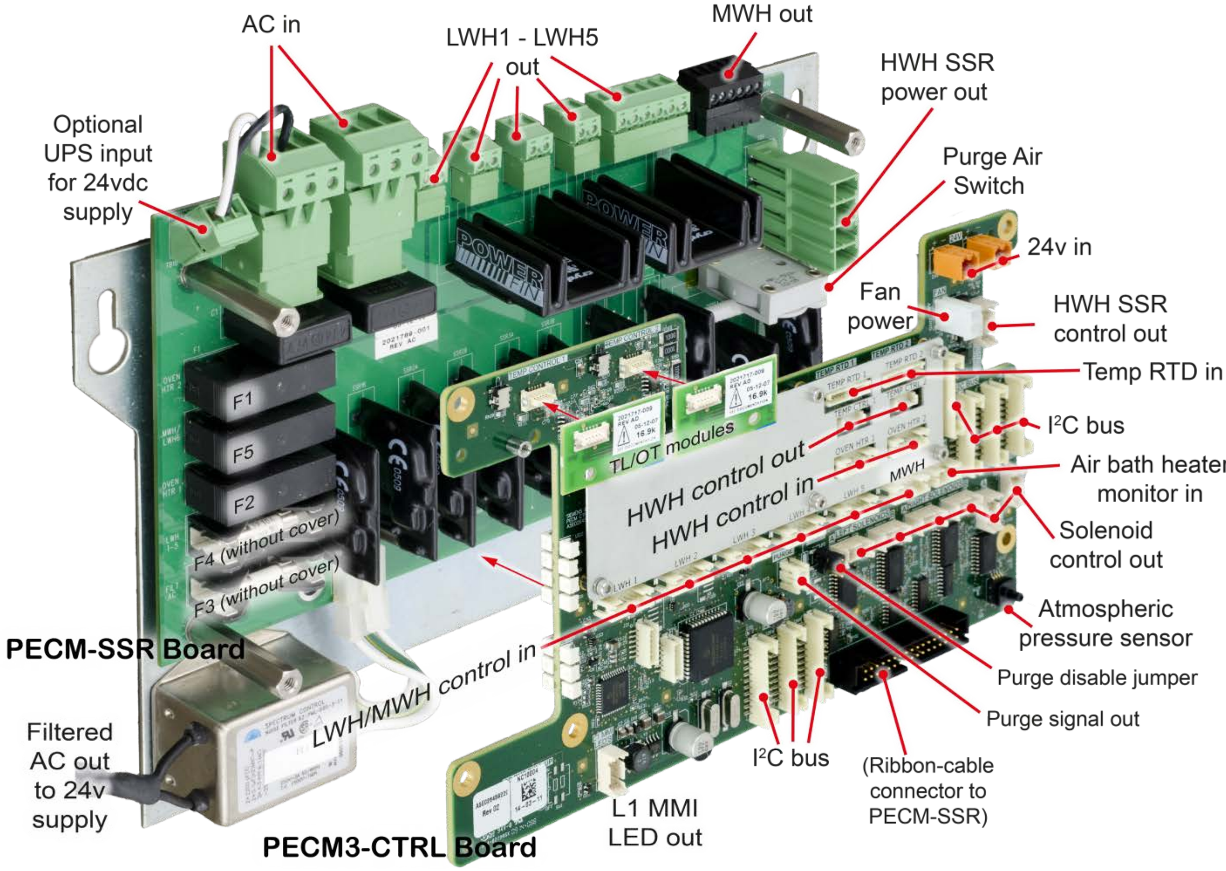


Figure 2-30 PECM3 I/O Connections

Part Number

The PECM3 assembly part number is 2021828-002. An upgrade kit, part number 2022019-001 is available to replace earlier units.

Feature Additions

Improvements in PECM3-CTL from PECM-CTL

- 7 I^2C connectors are provided compared to 4 on the previous PECM-CTL, eliminating the need for a Wiring Distribution Board (WDB).
- An Atmospheric pressure sensor has been added.

Improvements In PECM2 Assembly from Original PECM

The PECM design has changed since its original release. The newest version of this part is also used as the spare-part replacement for the previous version. The original PECM was a single electronic circuit board with a metal protective shield. It provided connection points for the electrical power coming into the Maxum GC and mounted low power electrical relays which could switch power to any electrical heater smaller than 200 watts.

The newest version of the module, PECM2, is a two part circuit board. One part connects the electrical power. The other part includes certain electronic circuits. Key features of the newer design are:

- Easy access (no cover)
- Two on-board temperature control circuits. May allow elimination of a DPM that is only used for temperature control, such as for heated valves and the methanator.
- Additional medium-wattage heater circuit.
- 4 connectors providing I^2C and 24V power distribution have been added. This replaces some of the function of the Wiring Distribution Board (WDB).
- Includes solenoid valve control which eliminates the need for individual SVCM controller boards. When converting older design and eliminating original SVCM controller boards, additional long cables are required.
- Improved low-profile fuse holders
- LED indicators for air pressure switch on air-bath heater circuits
- Built-in provision for connection of Uninterruptible Power Supply (UPS) for 24vdc circuits. The heaters are powered through different connectors to minimize the loading of the AC power needed for running the 24-vdc circuits.

PECM Functions

The PECM provides connection points to facilitate the functions listed below.

AC Input and Distribution

AC mains power is wired to TB1 and TB2. TB10 is an optional connection for an uninterruptable power supply for the 24 V power supply output, as shown in Figure 2-31.

Fuses

- F1-ABH2: 16 Amperes, 115 VAC or 10 Amperes, 230 VAC
- F2-ABH1: 16 Amperes, 115 VAC or 10 Amperes, 230 VAC
- F3-FLT AC: 3 Amperes 115 VAC or 230 VAC
- F4-LWH1-LWH5: 10 Amperes 115 VAC or 230 VAC.
- F5 LWH6, MWH

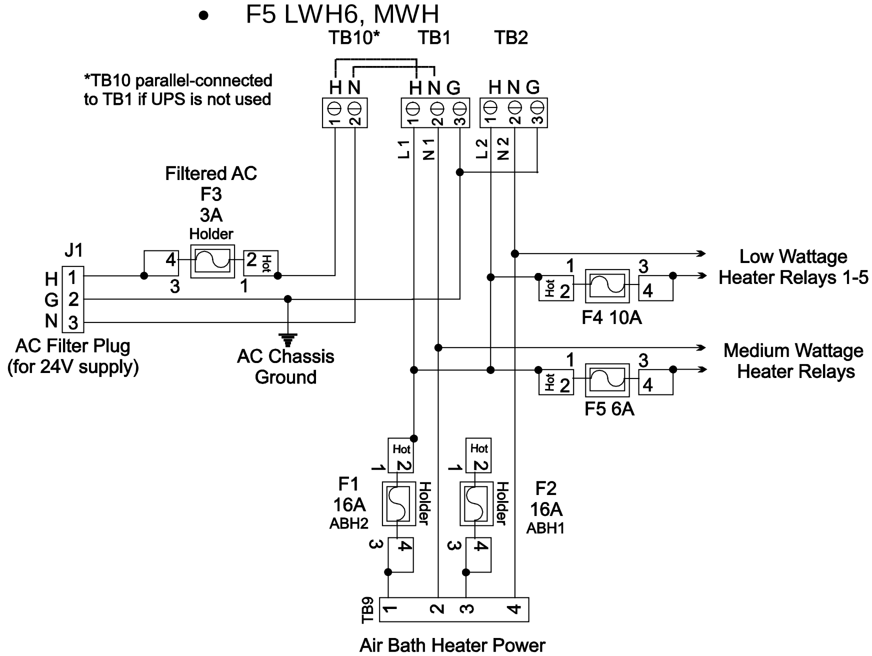


Figure 2-31 PECM AC Power Distribution

NOTICE

The power switching circuit is designed for either 115 VAC or 230 VAC. For safety reasons, the PECM is not designed to convert DC to AC. Attempted operation from a DC source will damage or destroy the PECM. To generate and control 115 VAC from a DC voltage system, the customer must use components external to the PECM.

I^2C and 24 VDC Distribution

The 24V power supply connects to one of two parallel power connectors, TB1 and TB2 on the PECM-CTL board. Another module can be powered from the other connector.

Each of the 7 I^2C connectors also provides 24V power to the connected module.

A separate connector powers a 24V fan.

Low-Wattage Heater SSR Control

The PECM has six solid-state relay circuits. These circuits can control low wattage (10 to 250 Watts) air bath heaters, heaters in the heated Flame Ionization and Flame Photometric detector housings or in heated sample injection valves, and can be adapted for on-off control of a sample valve or other device. The output voltage from each relay can either be 115 VAC or 230 VAC depending upon the mains supply voltage. Available outputs from the relays are on TB3 through TB8. Corresponding inputs are labeled LWH1 through LWH6. The LWH6 input controls the medium wattage heater (MWH) output. When a relay output is used for sample valve control, the supplied jumpers must be inserted in the corresponding input LWH1 through LWH4. (See Additional Relay Outputs below for using the individual SSRs in outputs 5 and 6.) For safety, since the power switching circuits are primarily designed for low-wattage air-bath heater control, each circuit has two series-connected SSRs, each being separately controlled. The jumper ties the two relays together to function as one output when they are not used for low wattage heater control. The circuitry is similar to the 1400-Watt High Wattage Heater Power Switching and it is controlled by signals from the Detector Personality Module (DPM) heater circuit. Figure 2-32 shows a simplified schematic of the Low Wattage Heater Relay Circuit LWH4.

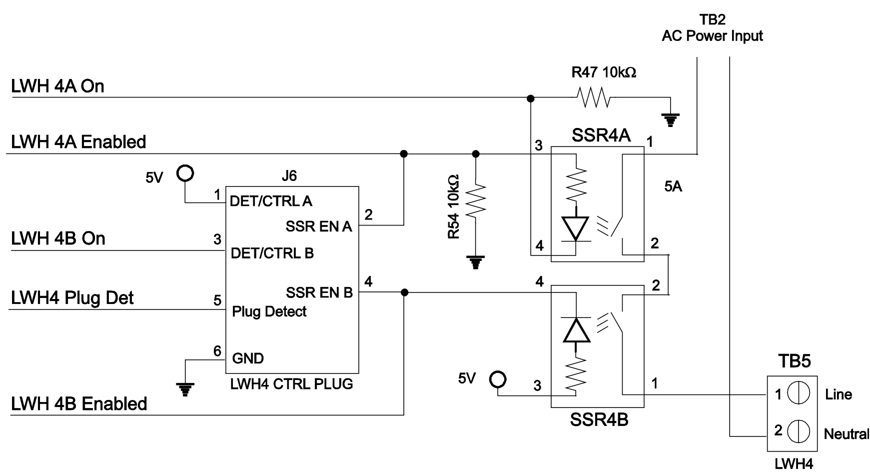


Figure 2-32 LWH4 Heater Circuits

Additional Relay Outputs

Relay circuits LWH5 and LWH6 when used for purposes other than on/off control of low wattage heaters can supply four separate outputs. A simple jumper on pins 1 to 2 on output connector TB7 or TB8 makes this possible. With the jumper in place, each connector will provide two independent outputs; see Figure 2-33.

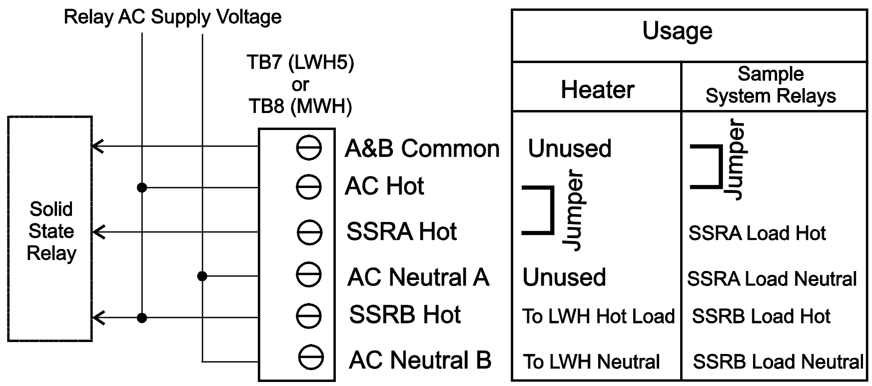


Figure 2-33 LW5 & LW6 Relay Circuit Jumper Connections

Oven Temperature Monitoring and Control

The PECM_CTL board has two temperature monitor and control channels for use with the high-wattage heaters (HWH). Each channel includes

- RTD input
- Mounting location and connector for setpoint module
- Comparator circuit
- PWM control signal output
- Control input (can accept an external control signal from another module if desired)
- Control output for HWH SSR module
- AC power output for HWH SSR

The HWH control path is shown in Figure 2-34.

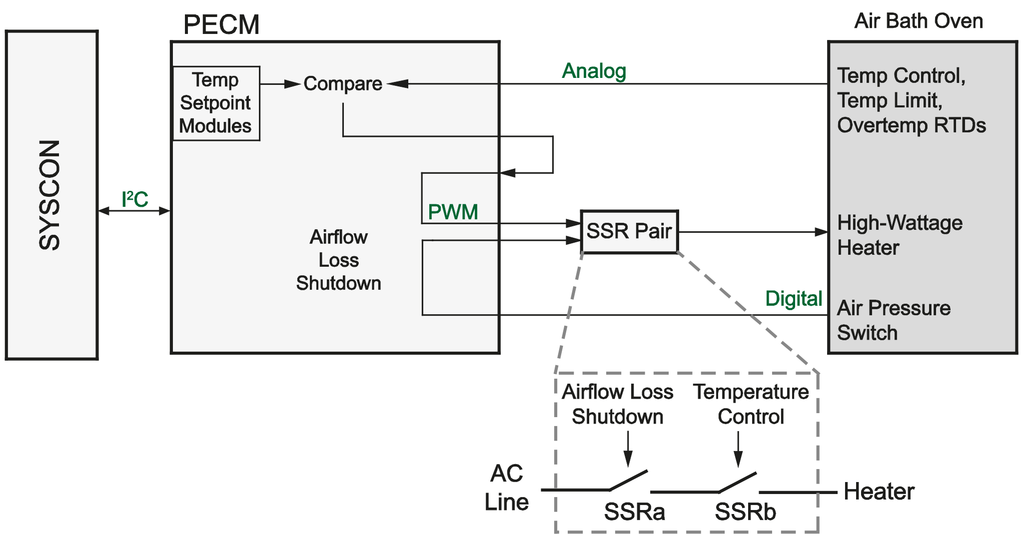


Figure 2-34 PECM High-Wattage Heater Control

Each circuit consists of two series-connected solid-state relays. One of these relays controls the 1400-Watt AC heater to maintain the set point temperature by monitoring the air bath RTD and heater pressure switch. The second relay is used for safety purposes. It performs an emergency analyzer heater shutdown if an over-temperature condition is detected. Both relay circuits are completely independent of each other. However; in order for the power circuit to be energized, both relays must be enabled. Temperature controls are monitored by the Detector Personality Module and routed to the PECM via a dedicated cable and connector, or by the temperature-control circuits on the PECM-CTL board itself. No other functions are connected to the temperature control circuit. The connections are EMC filtered. When over temperature is detected the PECM over temperature circuit inhibits the SSR from powering the heater.

Alarm conditions are reported to the SYSCON over the I^2C link.

Solenoid Control

Includes solenoid valve control which eliminates the need for individual SVCM controller boards. When converting older design and eliminating original SVCM controller boards, additional long cables are required.

Air-Bath Oven Air Supply Monitoring

The 1400-watt heater assembly is used in many air bath configurations (single isothermal; dual isothermal; or Programmed Temperature Control). A single heater is used for the single isothermal configuration and two heaters are used in the other configurations.

Additionally, a “medium power” Solid State Relay Module (temperature control relay module) is available. These smaller relays are capable of controlling the 500 watt air bath heater assembly. This can be used in single isothermal configurations where the controlled oven temperature is 70°C or less. In addition, the “medium power” SSR Module can be used to control the two 250 watt heaters used in the Maxum airless oven configurations.

See Figure 2-34 for connector locations.

Purge Monitoring

The PECM monitors the state of the purge condition for the analyzer. If a loss of purge is detected the purge switch is enabled. The purge control alarm signal is controlled by the SYSCON. The purge signal cable from SYSCON to PECM plugs into connector J1302 on the PECM2. Connection SW1 on the PECM2 is used to connect atmospheric reference for the purge switch.

When a purged enclosure is not required per the safety codes, connector J2 on the PECM2 can be used to disable the purge alarm. See Figure 2-34 for connector locations.

Atmospheric Pressure Monitoring (New for PECM-CTL3)

This sensor allows a Maxbasic program to measure the ambient atmospheric pressure for custom applications. A tube must be connected from the sensor (J44 on the PECM-SSR board) to the exterior of the EC.

L1 MMI LEDs

Maintenance Panel Level 1 consists of LEDs on the outside of the analyzer door. It is intended for use in GCs that are not equipped with the full feature Maintenance Panel. The PECM supplies the control signals for Maintenance Panel Level 1, if equipped. For PECM-1, the Maintenance Panel Level 1 connects to position J17. See Figure 2-34 for the location of connector J17.

Physical Location

The PECM is mounted to the left inside wall of the EC cabinet. All fuses and electrical connections are readily accessible.

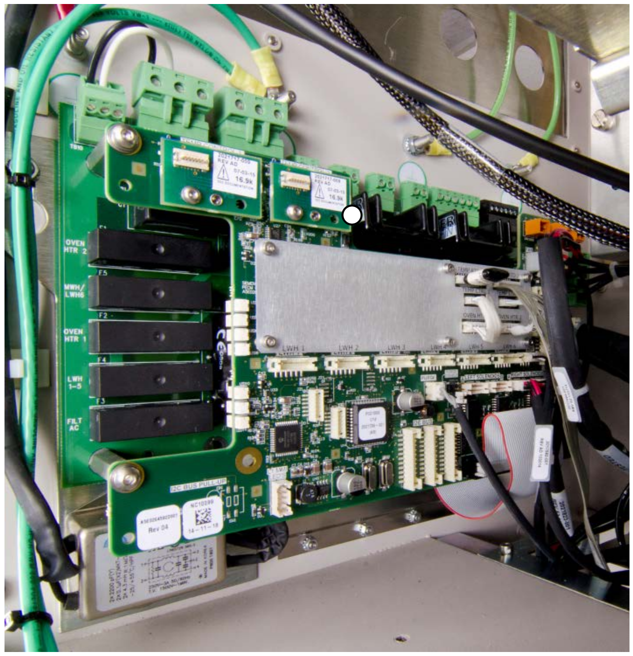


Figure 2-35 Power Entry and Control Module – Version 3 (PECM3)

Sensor Near Electronics (SNE) Software

Overview

The Sensor Near Electronics (SNE) is a software module that provides Maxum II Gas Chromatograph physics control, data analysis and data reduction. This virtual SNE operates as a set of intercommunicating tasks running on the pSOS+ operating system. These functions run on the SYSCON2.1 hardware in recent Maxum II analyzers. In older analyzers, these functions run on processors mounted in the SNE cage along with the DPMs. See Figure 2-36.

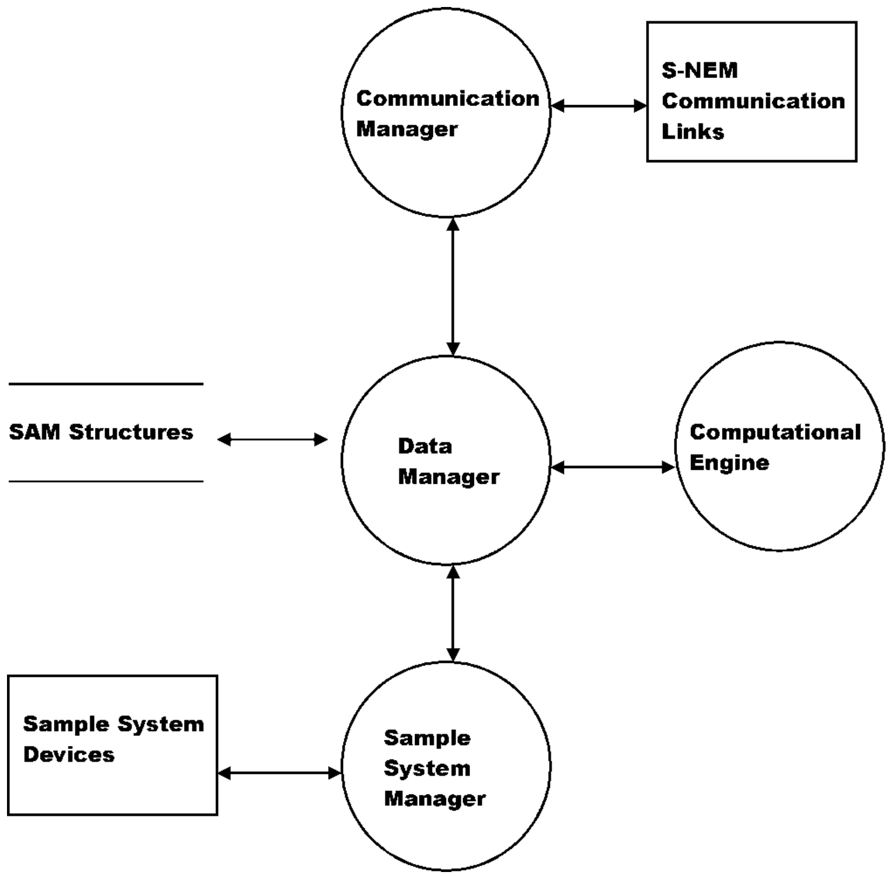


Figure 2-36 SNE Software Top Level Diagram

Configuration

The SNE is configured by the System Controller (SYSCON) and periodically reports analysis results. It can be interactively controlled for **Real-Time** decisions on operation scenarios. The SNE software controls all sampling relating to its internal configuration and sensor setup.

Components

The major SNE software components are as follows:

- Data Manager
- Communications Manager
- Hardware Manager
- Computational Engine

A synopsis of each major component is presented in the following sections. See Figure 2-36.

Data Manager

The Data Manager maintains configuration data that controls hardware sequence of events and controls what manipulation is performed on sampled data.

The Data Manager also provides results and status information to externally connected devices via the Communication Manager. This data is organized as a set of Sensor Analyzer Module (SAM) structures. The data represents the unit as a standard sensor to external host.

Communication Manager

The Communication Manager acts as a central point of control for communication links attached to the Sensor Near Electronics (SNE). This allows Internal SNE software to function regardless of which communication link is being used to communicate with the system.

Hardware Manager

The Hardware Manager provides scheduling and communication services for the hardware in the analysis zone. These include devices such as the following:

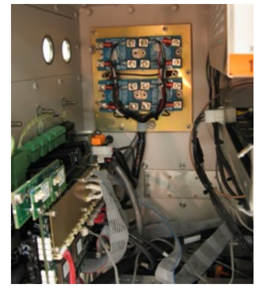
- Detectors,
- Sample valves,
- Relays,
- Pressure monitors and controllers,
- Temperature monitors and controllers and
- Flow control valves, etc.

Computational Engine

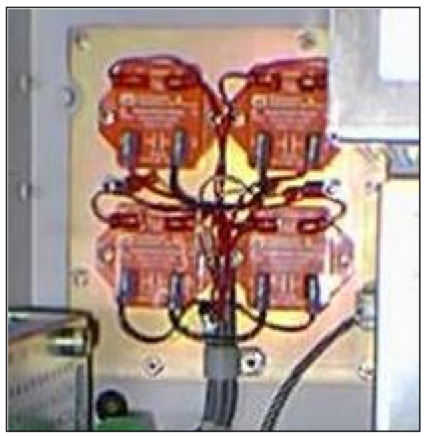
The Computational Engine takes acquired chromatography data and performs system calculations. Most of these calculations are performed by functions contained in the EZChrom method, which provides all peak identifications and integration and response factors.

Solid State Relay Module

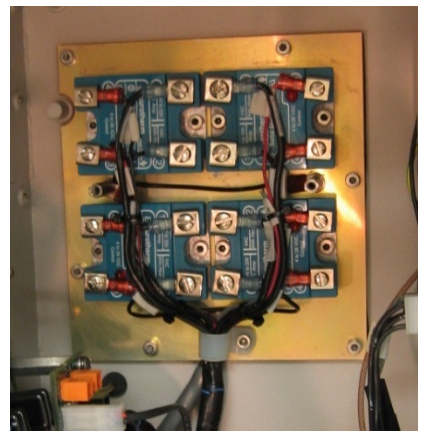
Description



The Solid State Relay Module is made up of two pairs of high wattage heater relays that are used for controlling the oven air bath heaters. One pair controls ABH1 and the other ABH2. Each pair of relays controls Temperature Limit and Oven Temperature shut down. If the over temperature limit is exceeded, the power to the air bath heater is shutdown. Two different configurations of Solid State Relay Module are available, the SSR and the Medium Wattage SSR. There are also two slightly different versions of the standard SSR. See Figure 2-37.



Old SSR



New SSR

Figure 2-37 Solid State Relay Modules (High Wattage)

Mechanical Information (High Wattage SSR)

The Solid State Relay Module assembly is mounted to the left side of Enclosure back wall. A metal cover not shown in Figure 2-37 protects the relays. The Module is equipped with heat dissipating fins that extend through the back of the enclosure wall to dissipate generated heat to the outside atmosphere.

The relays on the newer SSR provide an indicator LED which shows the operational status of the control signals. In addition the newer SSR is equipped with a plastic shield which covers the connection screw terminals and helps prevent inadvertent contact. Note, however, that the older SSR is entirely enclosed in a sheet metal housing so human contact is not possible without disassembly of the module.

Both the original and newer relays can be replaced and both are available as spare parts.

Electrical Information (High Wattage SSR)

The PECM provides the voltage to the two pairs of 1400-Watt AC Air Bath heater power switching circuits located on the rear wall of the electronic enclosure. A dedicated cable connects the PECM to the relay assembly. Each circuit has two solid-state relays connected in series.

One series-connected relay controls the 1400-Watt AC heater functions to maintain controller initiated set point temperature. In conjunction with the control signal, the air bath heater pressure switch enables the relay. The second series-connected relay is used for safety purposes. It performs an emergency analyzer system shutdown if an over-temperature condition is detected. Both relay circuits are completely independent of each other. However, in order for the power switching to occur both relays must be enabled. Temperature controls are monitored on the Detector Personality Module located in the SNE and routed to the PECM via a dedicated cable. No other functions are connected to the temperature control circuit.

Power Source

The heater element can operate from either 115 VAC or 230 VAC power sources with a total power output capacity of 1400 to 1500 watts. Figure 2-38 is a schematic of the air bath heater relay.

115VAC or 230VAC

If the primary AC voltage is changed from 115 VAC to 230 VAC, the Power Entry Control Module (PECM) AB1 and AB2 fuses must be changed. For 115 VAC power the fuses are rated at 16 amps. For 230 VAC, the in-line fuses must be changed to 10-amp rating. Also the 115/230 VAC switch must be set to 230 VAC. The switch is located on the Power Supply Module, mounted to the left side of SYSCON. In addition the correct power adapter must be plugged into the Heater 115V/230V connector; 115 VAC Power Adapter P/N 2017595-001 and 230 VAC Power Adapter P/N 2017595-002.

NOTICE

DO NOT use a 16-amp rated fuse for 230 VAC primary AC power. This could result in overheating and equipment damage.

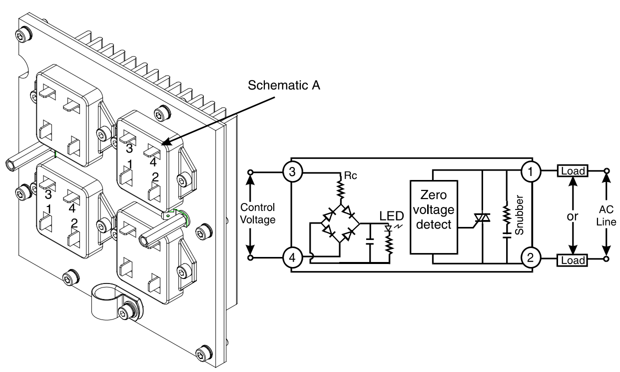


Figure 2-38 Air Bath Heater Relay Schematic

Medium Wattage SSR Module

A medium wattage version of the Solid State Relay (SSR) module is available. The original assembly included four large relays suitable for switching two of the 1400 watt air bath oven heater elements. However, many Maxum GCs do not require that much power. Therefore, a new SSR Module was added to the Maxum spare part offering which can lower spare parts costs. The newer board provides smaller relays which are capable of controlling the new 500 watt air bath heater assembly (described above). In addition, the “medium power” SSRB can be used to control the two 250 watt heaters used in the Maxum airless oven configurations. The newer board can also be used to control the low wattage heaters in the heated Flame Ionization and Flame Photometric detector housings or in heated sample injection valves.

The relays on the medium wattage SSR cannot be replaced individually. However, the module is easily replaced. Another difference between the high wattage SSR and medium wattage SSR is that the medium wattage version does not required heat dissipating fins on the back of the enclosure. The relays are equipped with heat sinks on the front of the module (which can be seen in the picture below).

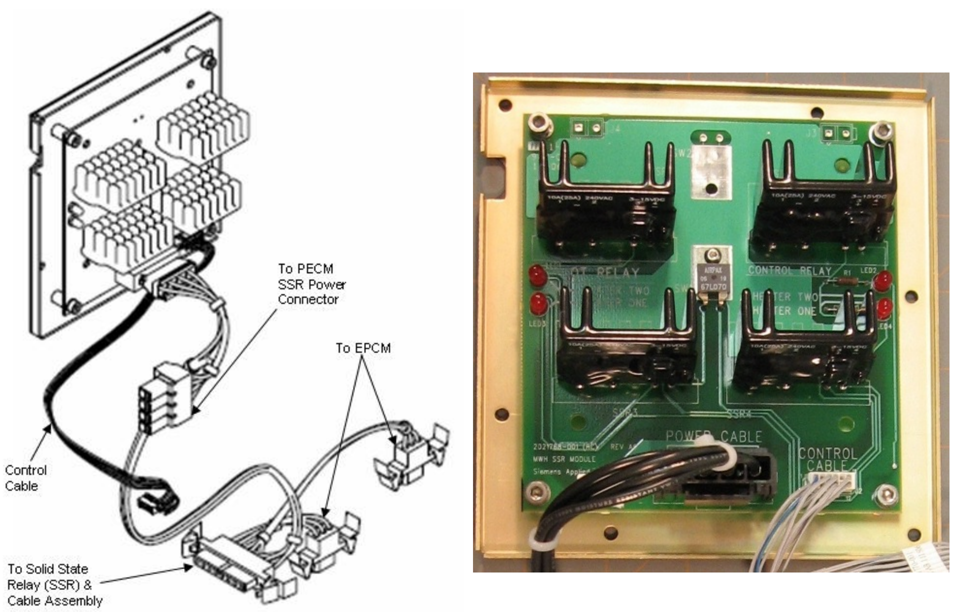


Figure 2-39 Medium Wattage Solid State Relay Module

Solenoid Valve Control Module (SVCM)

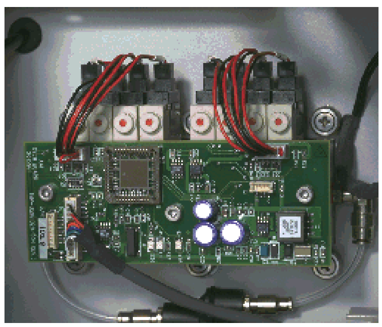
Description

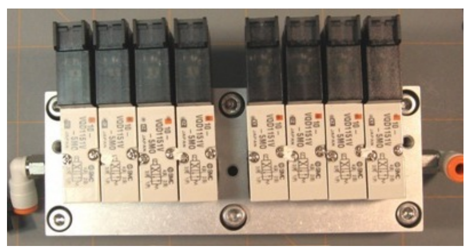
The Solenoid Valve Control Module (SVCM) provides pneumatic interface to control flow to the oven sampling and column valves. Solenoid valves are suitable for air, nitrogen and helium on the pressure side and vacuum on the vent side. The electronic enclosure has space for up to three modules.

SVCM Versions

There are two configurations of SVCM. The old version, which is still supported as a spare part, is equipped with a valve driver circuit board. For the newer version of the SVCM, this valve drive circuitry has been moved to the PECM2 module. The newer version has a lower cost and is more reliable.

The SVCM electronics, whether onboard for the old version or on the PECM for the new version, receives commands from the SYSCON module (via the I^2C). Pulse timing is controlled from the SVCM electronics.





Original SVCM **New SVCM**

Figure 2-40 Solenoid Valve Control Module (SVCM)

Mechanical

Each SVCM incorporates 8 solenoid valve circuits for driving 3-way and 4-way solenoid valves. The SVCM is mounted in the Controller Enclosure on the manifold block. It can also be mounted in a Division 2 purge enclosure. Up to 3 SVCM assemblies can be mounted in the Maxum II. This allows for up to twelve 3-way solenoids and twelve 4-way solenoids. SVCM-1 is mounted in the lower right portion of the back wall. SVCM-2 is mounted in the lower left portion of the back wall. SVCM-3 is mounted (vertically) in the upper right portion of the back wall. The original SVCM is equipped with Parker solenoids. The newer SVCM is equipped with SMC solenoids. Manifold in/out SST tubing connections incorporate one touch push type tubing connectors.

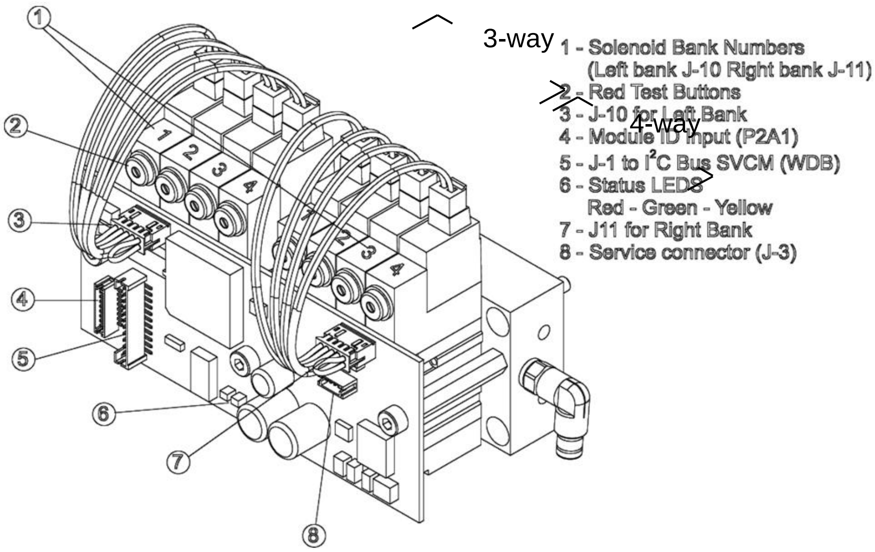


Figure 2-41 Original Solenoid Control Module

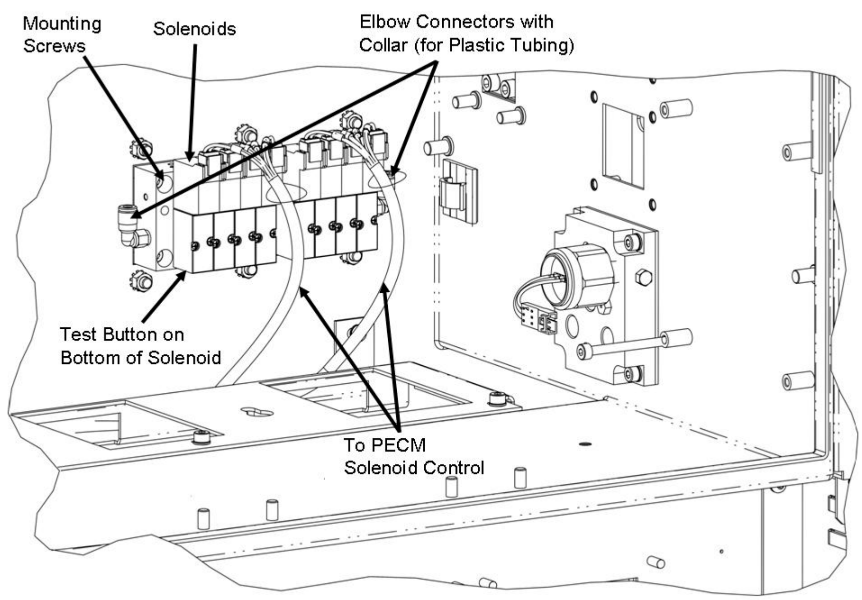


Figure 2-42 New Solenoid Control Module

Digital Outputs

Digital outputs assigned to each solenoid valve are shown in Table 2-5. If a digital output is 0 the valve is OFF; if the output is a 1, the valve is ON. Each group of four valves is identified as being left or right. There are no digital inputs. Refer to See Table 2-5 for the numbering pattern of solenoid valves (same for original and newer versions). Each solenoid valve can be manually set to the ON or OFF conditions by manually depressing the red button on each solenoid. This button is on the top-front of each Parker (original) solenoid and on the bottom of each SMC (new) solenoid. See Figure 2-41 and Figure 2-42 for the button location.

Table 2-5
Digital Output Solenoid Valve Groups

Group	Solenoid Valve
Left	Valve 1
Left	Valve 2
Left	Valve 3
Left	Valve 4
Right	Valve 1
Right	Valve 2
Right	Valve 3
Right	Valve 4

SVCM I/O Assignments

Table 2-6 shows the specific digital output I/O assignment summary. For location of solenoid valves, see Figure 2-41 and Figure 2-42. There are no analog inputs or outputs.

Table 2-6
SVCM I/O Assignments

Signal Type	SYSCON Channel #	I/O Name	Group #	Channel #
DO	1	LEFT_GROUP_VALVE_1	1	80h
DO	2	LEFT_GROUP_VALVE_2	1	40h
DO	3	LEFT_GROUP_VALVE_3	1	20h
DO	4	LEFT_GROUP_VALVE_4	1	10h
DO	5	RIGHT_GROUP_VALVE_1	1	08h
DO	6	RIGHT_GROUP_VALVE_2	1	04h
DO	7	RIGHT_GROUP_VALVE_3	1	02h
DO	8	RIGHT_GROUP_VALVE_4	1	01h

SVCM Fault Indicators

Table 2-7 shows the specific SVCM fault indicators and condition causing the error. For J10 and J11 connector locations in the original SVCM, see Figure 2-41. See Figure 2-30 in the PECM2 section of this chapter for the locations of connectors for the new SVCM.

Table 2-7
Fault Indicators

Fault Indicator	Fault Condition
VALVE_SWITCH_ERROR	Valve status read back is incorrect
J10_DISCONNECTED (left bank connector)	J10 connector not connected
J11_DISCONNECTED (right bank connector)	J11 connector not connected

Status Lights

Table 2-8 shows the SVCM board mounted status lights (for the original SVCM) and their assignments. For location of LED status lights, see Figure 2-41.

Table 2-8
Status Lights for Original SVCM

LED Status Light	Color	Assignment
LED1	Green	When illuminated, it indicates valve communication and power is ON.
LED2	Red	When illuminated, it indicates there is a condition causing a fault.
LED3	Yellow	When illuminated, it indicates a warning status.

Operation Test

Step	Procedure
1.	Using a fine pointed object, depress Solenoid Valve red button.
2.	When depressed, pressure is applied to the piston that moves to either the open or closed position. Resulting pressure is then applied to the column or sample valve.
3.	If piston does not operate when the button is depressed, check for correct gas pressure.
4.	If piston does not operate and pressure is 75 psig, Solenoid Valve is defective and must be replaced.
5.	Repeat for each valve operating on and off. Allow at least 1 second between depressions.

Specifications

The following specifications are applicable to the SVCM.

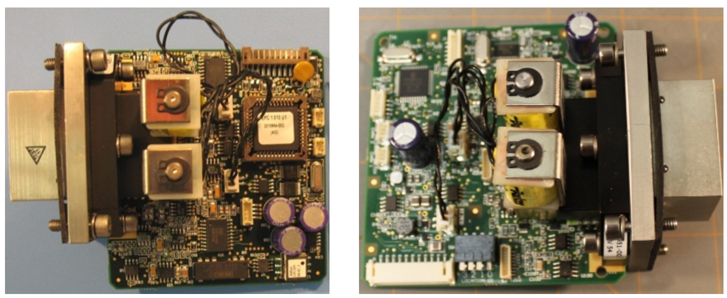
Function	Specification
Switching Speed (Maximum response time on/off ms)	
4-way	15 ms
3-way non-latching	15 ms
Operating Voltage	24 VDC
Pressure Range, 3-way	25 to 100 psi
Pressure Range, 4-way	25 to 100 psi
Maximum PSI	100 psi
Vacuum Range	0 to 27" of Hg
Ambient Temperature Range	-18°C to 65°C -0.4°F to 149°F (dry air)
Leakage	Not greater than 50 micro Liter/min, air @ 69.8°F (21°C) with 50 psig on the common port.

Electronic Pressure Control (EPC) Module

Description

The Electronic Pressure Control (EPC) Module reduces oven set-up time by using precise pressure control without restrictors or needle valves. This module also allows programmed pressure control for faster chromatography and modern applications. It allows for precise resetting of pressures. The EPC can be used for both carrier and fuel gas supply, which eliminates the less reliable mechanical regulation. Four independent EPCs can be installed in one Maxum II.

Each EPC provides two independently regulated pressures for use on carrier and flame fuel sources in the oven. Gas connection is located in the regulator section. Regulated pressure range is 5-100 psig. Two slightly different versions of the EPC are available. The primary difference between the two versions is that the newer version is equipped with DIP switches that identify the location ID of the module. The older version uses a jumper plug to identify the ID. The differences between these methods of identification are described fully in the procedure to replace the EPC, found in Chapter 4 of this manual. There are no other functional differences.



Older Version Newer Version (with DIP Switches)

Figure 2-43 Pressure Control Module (with Attached Manifold)

Mechanical

The EPC is mounted to right side wall of the Electronic Enclosure. For mounting location, see Figure 2-44. Up to four (a total of 8 EPC channels) can be installed in a single Electronic Enclosure. The EPC is easily field replaceable using common tools.

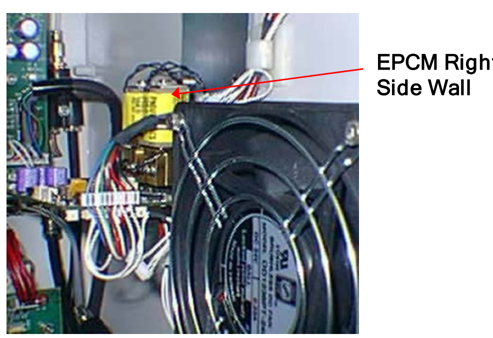


Figure 2-44 EPC Component Location

Electrical

The EPC is made up of a printed circuit board with two pressure transducers, two proportional valves with associated electronic circuitry, manifold for pneumatic connections, PC connector for communication signals and a DC power connector. See Figure 2-44.

The EPC provides electrically controlled pressure for helium, hydrogen and nitrogen carriers etc., as well as low flow and low pressure (<100 psi) applications such as flame detector fuel. The EPC operates from +24 VDC at 4 watts. Electrical connections are made using plug type connectors.

The EPC receives commands from the Sensor Near Electronics Controller (SNECON) via I^2C bus regarding timing and pressure setpoint. The timing of messages from the SNECON controls timing within the EPC. There is no time base in the EPC. Module control is established by sending parameters, such as setpoint pressures and ramp rates to the EPC. The EPC is used in the Maxum II to control the carriers and/or fuels for the detector modules. The EPC can also be used in field-mounted installations.

The EPC communicates with other components via the I^2C bus and communicates actual pressure back to the SNECON. Regulated pressure range is 5-100 psig.

Channels

Each EPC channel consists of a pressure sensor amplifier and analog filter followed by an A/D Converter. The converter is read by the local controller that calculates a new control value used to control the proportional solenoid valve.

Control parameters, such as set-point pressures are sent, via the Sensor Near Electronics Controller (SNECON) I^2C, to the EPC. Status and diagnostic data is available via the SNECON I^2C.

Non-Volatile Memory

The initial control parameters and calibration parameters are stored in SYSCON On-Board non-volatile memory. With this type of memory, data is not lost in the event of a power failure or turning system power off.

Diagnostics

EPC diagnostics are read-back of setpoint pressure via the software, DC power within operating limits, monitoring of line and short-term pressure variations with respect to the setpoint regulation, out of range pressure alarm and a diagnostic failure.

Specifications

The following specifications are applicable to the Electronic Pressure Control (EPC) Module:

Topic	Specification
Maximum inlet pressure	120 psig
Pressure output range	5-100 psig
Minimum differential between EPC inlet and outlet	5 psi
Flow range from EPC	5-500 cm^3/s (see note below)
Controlled pressure stability over temperature range	±0.5% of setpoint
Short-term pressure stability	±0.0005 psi over 30 seconds
Typical response time for step change in setpoint.	Stable to within 0.1% of final value within 0.5 seconds* * (For hydrogen the response time is ~ 1 second).

Note: When running applications with column flow rates of less than 5 cm^3/s, a separate bleed flow path is recommended in order to reduce the time required to achieve pressure stability when variable setpoints are used. Depending on the volume involved, a bleed flow rate of 5-10 cm^3/s is recommended.

Power System Module (PSM)

Overview

The Power System Module (PSM) is a 110/230 VAC switching power supply that provides 24 VDC operating system voltages. It also provides 110/220 VAC conditioning. The 24 VDC power supply provides high speed switching with power factor correction and universal input. The PSM is a stand-alone system consisting of a power supply, filtering, circuit fuse protection and a power monitor board.

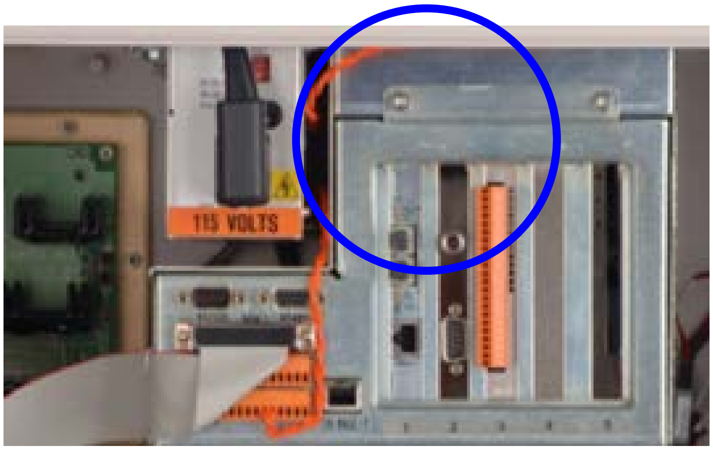


Figure 2-45 Power System Module (PSM)

Input AC Power

AC power input to the power supply is from the Power Entry Control Module. A line cord from the PECM plugs into the front AC receptacle of the power supply. A primary input power selector switch (located above the AC receptacle) must be set to match the primary AC voltage input from the Power Entry Control Module.

Output Connections

Output 24 VDC is supplied to components within the Maxum II via a cable harness that exits the backside of the PSM. The cable terminates in quick disconnect connectors.

Circuit Analysis

Primary AC power is conditioned and converted to 24 VDC. After conditioning; only one 24 VDC source is supplied to system components. DC to DC converters generate other operating voltages.

24 VDC

The PSM provides only one 24 VDC source to operate system components. A blocking oscillator generates the 24 VDC output voltages at 6 amps. Operating voltages for other components within the analyzer are generated by the 24 VDC using DC to DC conversion.

Specifications

The Power Supply Module specifications are presented below. Note that these specifications are specific to the PSM and may differ from the overall Maxum specifications.

Voltage Range	115 VAC (85 to 140 VAC) 230 VAC (185 to 264 VAC)
Frequency Range	47 to 63 Hz
Nominal Input Current	2 amp @ 115 VAC 1 amp @ 230 VAC
Output Rating	24 VDC @ 6 amp
Nominal Output Voltage	24 VDC ± 3%, 1% ripple plus noise at a bandwidth of 30 MHz
Nominal Output Current	6 amps @ <104°F (40°C) 4 amps @ 104 to 158°F (40 to 70°C)
Basic Load	0.2 amps/0.0 amps open circuit permitted
Dynamic Load	Between 0.2 amps to 3 amps in the load range. A maximum load of 2 amps at 1.8 kHz is switched. Switching is controlled by pulse width. Precision range is not exceeded in this operational mode.
Current Limitation	Start at 6.4 to 7.5 amps. When current drops, device is switched on.
Overvoltage Cutoff	Starts 27 to 31 VDC. When voltage drops, device is switched on.
Over-temperature Cutoff	After temperature decreases to specified tolerance, device is switched on.
Power Fail Transitions	Occurs 20 ms after a primary power failure. Should a power failure occur, a low 20 ms signal is generated.
Electric Isolation	Input/Output: 3.7 kV
Size	Length: 10.24 inches (260 mm) Width: 2.36 inches (60 mm) Depth: 3.54 inches (90 mm)
Cooling	Convection and conduction through aluminum mounting plate.
Output Wiring	Cable harness

PSM Fuse Replacement

The Power System Module is equipped with a fuse (Siemens Part Number A6X19905350). This fuse is located on the front of the PSM just above the power cord plug. The fuse is a 250V, 4.0 Amp, “slow-acting” type. Although this fuse rarely fails, replacement is simple (disconnect power to the analyzer first). To remove the fuse, unplug the power cable that comes from the PECM. Access the fuse by removing the fuse cap with a large blunt screwdriver.

Siemens Liquid Injection Valve

Description

The Siemens Liquid Injection Valve (SLIV) is used to automatically inject a fixed quantity of liquid sample followed by fast, complete vaporization. Small gas quantities can also be injected using the valve. See Figure 2-46 below.

Components

The Siemens Liquid Injection Valve (SLIV) consists of three components:

- Temperature-controlled vaporization system
- Sample flow unit with seals
- Pneumatic drive (actuator)

Figure 2-46 Siemens Liquid Injection Valve

Functional Description

The SLIV uses a moving injection tappet attached to a piston actuator. Sample is injected via a groove or cross hole in the tappet. In the filling position, the sample flows continuously through the cross hole or the ring groove of the injection tappet. When injecting, the tappet is pushed pneumatically into the heated vaporization area. The liquid in the cross hole or ring groove is vaporized and flushed by the carrier gas into the column. The tappet is then shifted pneumatically, via the piston actuator, back into its original position. Sample then passes through the injection hole again. See Figure 2-47 on the next page.

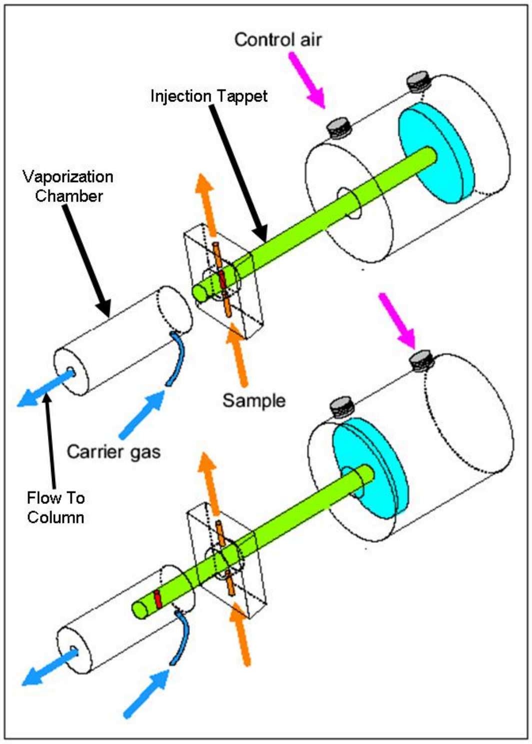


Figure 2-47 LIV Sample Injection

Specifications

Max. Vaporization temperature	60 - 300°C (140 - 572°F) with explosion-proof analyzers according to the temperature class
Injection volume	0.4 to 2.5 μl
Ambient temperature	-20 to150°C (-4 to 302°F)
Material of parts in contact with the sample	V4A, mat. No. 1.4571 Hastelloy, Monel or special
Control pressure	4 to 6 bars (48 to 87 lb/sq inch)
Sample pressure	Max. 50 bars (725 lb/sq in), recommended 5 … 10 bars (72.5.145 lb/sq in)
Connections	For tube with 3 mm (1/8 in.)outer diameter

Vaporization system

The vaporization tube is inserted with an aluminum sleeve into the heating mushroom plate whose temperature is regulated by a heating cartridge. In addition to the standard vaporization tube, a version of the SLIV is offered with a glass lined vaporization tube.

The carrier gas is routed via tube into the vaporizer and heated up to the vaporization temperature in the process.

Sample flow unit

The sample flow unit (Figure 2-48 below) is located in the middle section (body) of the valve between the vaporizer and the actuator piston. It is isolated from the vaporizer and actuator by lens shaped Teflon gaskets. An adjustable adapter and Belleville washers position the Teflon gaskets with a constant pressure and compensate for temperature expansion effects and gasket wear.

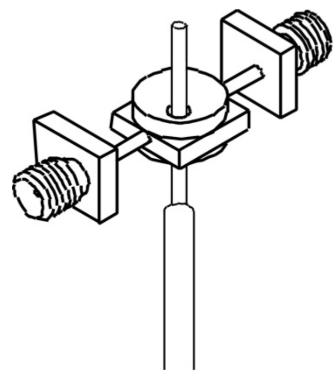


Figure 2-48 Sample Flow Unit

Vaporization Temperature

The vaporization temperature can be set independent of the oven temperature. It is selected according to the sample and the boiling point of the sample. The optimum vaporization temperature must be determined experimentally. The amount by which the vaporization temperature should be above the sample’s boiling point depends on the heat of vaporization of the sample. Samples with a high heat of vaporization, such as aqueous samples, only vaporize sufficiently fast for chromatographic purposes at high temperatures (above 200°C), as shown in Figure 2-49.

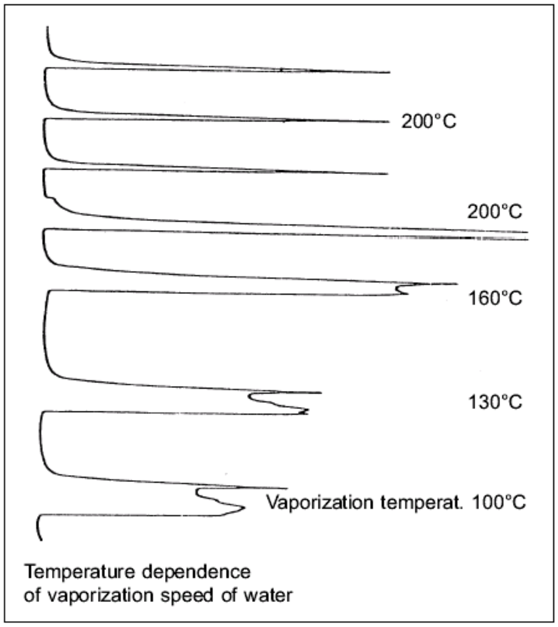


Figure 2-49 Vaporization Temperature

NOTICE

EX units: To comply with electrical hazardous area requirements ensure that:

- The sensor of the temperature sensor is fully inserted into the heating plate.
- The purge tube vent is not being obstructed.

Filter Requirements

The tappet and gaskets will wear faster if the sample contains solid particles. In these cases, a filter is required upstream of the injection. Siemens recommends a filter with the following characteristics:

- 98% for 0.3-µm particles with liquid samples
- 99.99% for 0.1-µm particles with gaseous samples

Flame Photometric Detector

Description

The FPD is a selective detector that can detect sulfur based on the emission of light during combustion. It is intended for use only in the Maxum II. Two versions have the FPD have been available for the Maxum II. In 2007, enhancements were made to the original FPD. The enhanced FPD is called FPD II. The original FPD and FPD II are very similar. All information in this section refers to both versions unless otherwise specified.

The components leaving the column are combusted in a hydrogen rich flame. They then generate light with wavelengths specific to the material. An interference filter permits only those wavelengths which are characteristic for Sulphur to pass on to the photomultiplier. The photomultiplier generates an electric signal proportional to the amount of material passing through the flame. It is also possible to detect phosphorus in this manner; however, detection of phosphorus would require a different filter and is not supported in the Maxum II at this time.

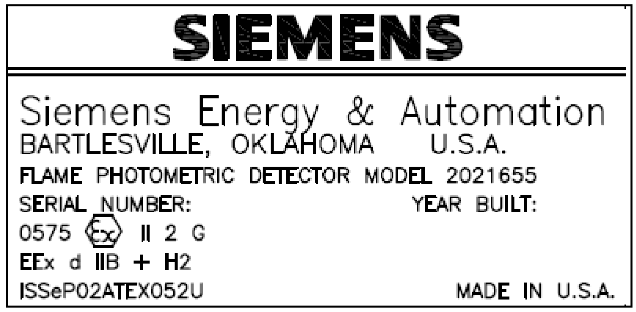
Specifications

Detection limit for sulfur (Original FPD) Detection limit for sulfur (FPD II)	2×10^{-11} g/s 7×10^{-13} g/s
Characteristic for sulfur	Quadratic: $[S]^2$
Operating temperature range	80°C to 150°C
Ignition type	Glow Plug
Electrical Data	2 Volts / 3 Amps (Maximum, only for flame ignition)

Labels

Below are sample views of the certification labels affixed to the FPD.

Original FPD



FPD II

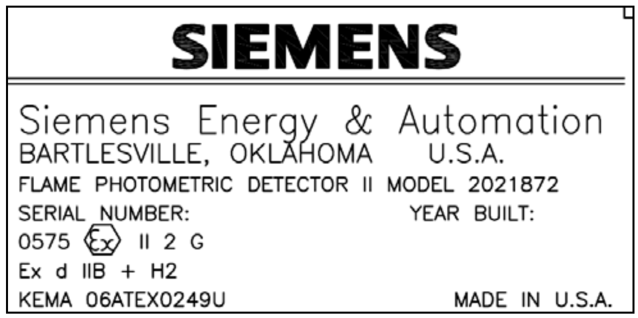


Figure 2-50 Certification Labels

Conditions for Safe Use per ATEX Certificate

- The FPD shall be protected against mechanical damage by mounting inside another enclosure.
- The relative maximal pressure existing inside the flameproof enclosure shall not exceed 0.065 bar.
- The grounding of the FPD shall be ensured by mounting to a metallic frame.
- The external part of the bushing shall be protected by pressurized enclosure “p”; not included in the ATEX certificate.

Design

The FPD comprises:

- Bottom part contains connections for combustion gas, combustion air, column and exhaust, and a burner nozzle.
- Top part contains combustion chamber, glow plug and fiber optic interface

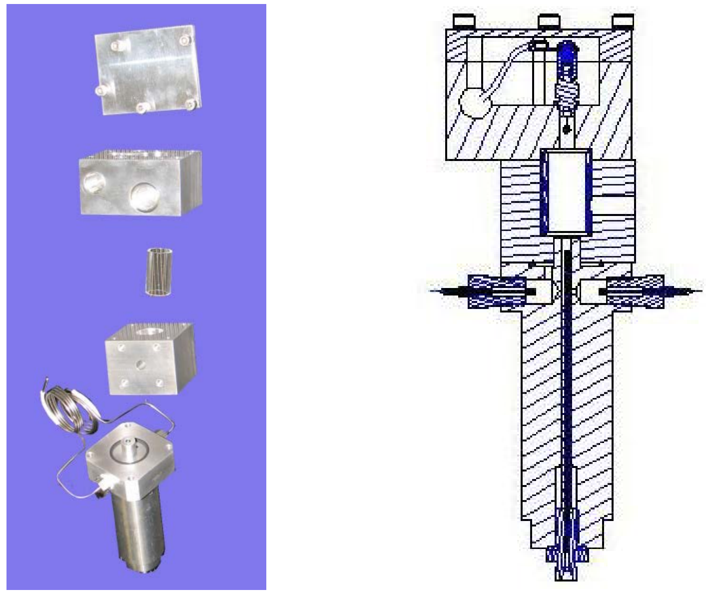


Figure 2-51 Flame Photometric Detector

Combustion Chamber

- The burner nozzle consists of two annular gaps. The combustion gas H_2 flows out of the outer annular gap and mixes with the combustion air from the inner gap. The carrier gas flows from the nozzle into the dome-shaped flame.
- The exhaust is taken from the combustion chamber output via a flameproof joint.
- The glow plug is located above and to the side of the burner.

Optics

- The flame burns in a recessed area shielded from the fiber optic interface.
- The fiber optic cable connects to the photo multiplier tube (PMT) module in the EC.
- The optical interference filter is built into the PMT module
- All connections between the combustion chamber and the photomultiplier are absolutely light-tight.
- The ignition cable of the FPD is routed through an EEx-e feed through to the EC.

Heater

The FPD is supplied with an external heater. Condensation would be formed in the FPD at temperatures below 80°C and have a negative influence on the measuring properties. The detector is insulated to prevent moisture from entering it.

The detector temperature is factory set depending upon the application. The temperature is normally set equal to or higher than the oven temperature and at minimum 80°C.

Detector Gas Supply

The FPD requires the following gases:

Type of Gas	Gas Quantity
Combustion Gas Hydrogen (Original FPD) Combustion Gas Hydrogen (FPD II)	75-85 ml/min. 60- 130 ml/min.
Combustion Air (Original FPD) Combustion Air (FPD II)	110-130 ml/min. 50-135 ml/min.

IMPORTANT

The FPD is a very sensitive detector. The gases and their supply lines must be extremely clean and sulfur free to achieve a high signal/noise ratio.

Selection of Carrier Gas

Nitrogen, helium, argon or hydrogen can be used as the carrier gas. If hydrogen carrier is used, the required flow of hydrogen flame fuel will be reduced. For the FPD II, the total hydrogen flow (combined flame fuel and carrier) will be ~100-130 mL/min.

Increasing the Sensitivity

The sensitivity of the FPD can be increased by reducing the flow of combustion air. Most of the time, the FPD cannot be ignited with a normal air/hydrogen ratio. If an electronic pressure controller (EPC) is used for the combustion gasses an event will be written at the factory, which will automatically adjust the flows during the ignition sequence. To obtain the recommended flow settings for an analyzer, refer to the custom documentation supplied with that analyzer.

Flame Ionization Detector

Description

The flame ionization detector (FID) is used for measuring hydrocarbons. It responds to most carbon containing compounds.

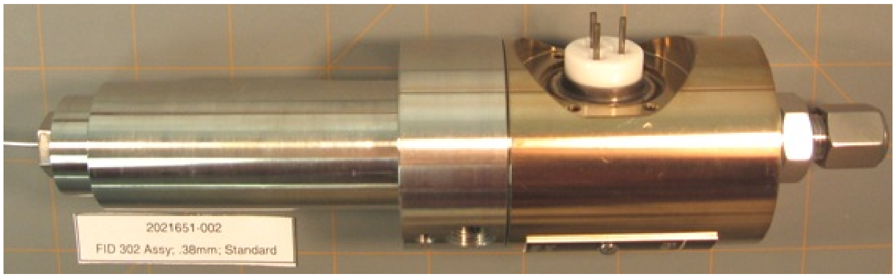


Figure 2-52 Flame Ionization Detector

Measurement Principle

See Figure 2-53. The output from the separation column is burned in a hydrogen flame. The ions produced are captured by the collector electrode and generate ionization current. This measurement current I_D is converted to a measurement signal U_A in the amplifier.

Within the linearity range, the measurement signal is proportional to the number of hydrocarbon atoms that are burned per time unit. The measurement signal also depends on the bonding types and possible presence of heteroatoms in addition to the carbon. Detector geometry and gas supply are calibrated so that the sensitivity and structural linearity are optimal.

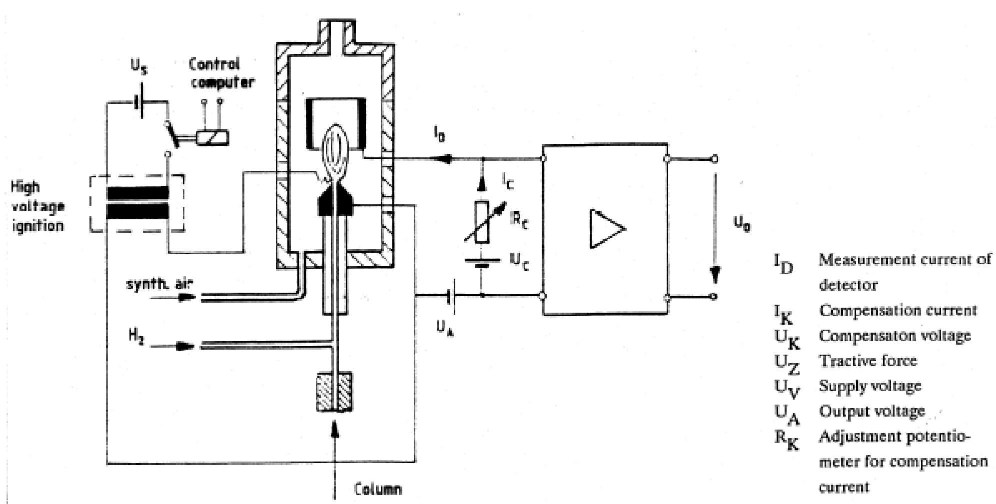


Figure 2-53 FID Block Diagram

Ignition Spark

The high voltage igniter module is comprised of a switching stage and a high voltage transformer that is used to generate the voltage for the ignition spark. The ignition module is in a separate unit from the detector.

A new igniter module has been developed for the FID. Refer to the Maintenance Chapter of this Manual (Chapter 4) for more information regarding the new igniter module.

Configurations

- Non Ex Module
- Explosion Proof (Ex Certified Module

Specifications

Detection limit	Approx. 1 x 10^{-12} g C/s
Absolute sensitivity	Approx. 2 x 10^{-3} As/g C
Concentration range	Approx. 10 ppb ... 10^{4} ppm
Linearity range	10^{-12} ... 10^{-5} g C/s
Basic current at 250	3 ... 7 x 10^{-12} A
Noise at impedance 0	Approx. 10^{-13} A
Noise at impedance 2	Approx. 4 x 10^{-14} A
Max. operating temperature	180 °C (T3), 280 °C (T2)
Ignition type	High voltage spark

Detector Gas Supply

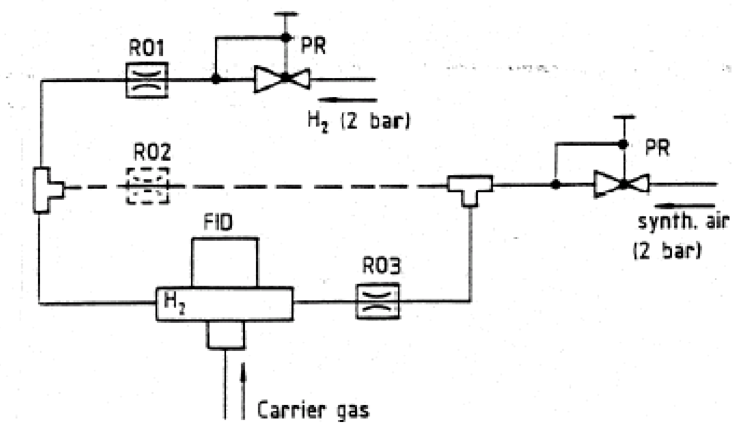
Reaction Gas - The FID requires both hydrogen and combustion air (synthetic air or purified air).

Reaction Gas - The FID requires both hydrogen and combustion air (synthetic air or purified air).

Carrier Gas - Hydrogen, nitrogen, argon or helium are suitable carrier gases.

Additive/Make-up Gas - To increase the sensitivity of the FID and to improve the structural linearity, air is added to the combustion gas via R02. When operating with Nitrogen as carrier gas this additive is not required.

If the Hydrogen carrier gas stream is below 20 ml/min Siemens recommends the addition of Hydrogen combustion gas to achieve a stable flame and, if necessary, air to increase the sensitivity.



Pressure reducers R01 to R03 are installed in the combustion gas inputs on the side of the detector.

Figure 2-54 FID Gas Supply

Maintain a Clean Supply Gas

The FID is very sensitive to all types of hydrocarbons and to any contaminates in gases or supply lines. For a high signal/noise ratio ensure that the gases have a purity of 99.995 % and hydrocarbon content below 2 vpm. For special detection sensitivity filter all supply gases using a molecular sieve filter. If plant air is used a catalytic air treater is strongly recommended to reduce the possible hydrocarbon content of the air.

Sensitivity

The temperature of the detector flame and the size of the combustion zone determine the sensitivity of an FID as do the composition and the flow speed of the gas mixture. For an optimum signal/noise ratio use following gas flow rates:

Combustion gas	20	to	45	ml/min
Combustion air	300	to	500	ml/min
Additive air	20	to	40	ml/min

Pressure Regulators

The electronic pressure control modules control the gas flow rate to the detectors. The flow rates can be adjusted. The carrier gas flow rate can be ~20 to 40 ml/min, but it should never exceed 60 ml/min including the additive.

Methanator

Description

The methanator (Figure 2-55 and Figure 2-56) is used with a Flame Ionization Detector (FID) when it is necessary to detect carbon monoxide (CO) or carbon dioxide (CO_2). In the methanator CO and CO_2 are chemically changed to methane using excess hydrogen and a catalytic reaction. The concentration of methane, which can be detected using an FID, is proportional to the concentration of CO and CO_2. In this manner, it is possible to detect CO and CO_2 using an FID.

Two versions of the methanator exist. The original version is designed such that it is an extension of the purged Electronics Enclosure (EC). It is connected to the CD via a pipe through which purge air flows. This prevents explosive gases or vapor from entering the methanator and contacting the hot surfaces.

The newer version of the methanator is an explosion proof version. This version is sealed within an explosion proof enclosure. The interior of the explosion proof methanator is designed somewhat differently than the original, but the theory of operation is identical.

Methanator Operation

In the methanator, CO and CO_2 are catalytically reduced to methane under excess hydrogen, which can be detected in the FID. The catalytic reaction can be described as follows.

$$CO + 3\,H_2 \xrightarrow{Ru} CH_4 + H_2O$$

$$CO2 + 4\,H_2 \xrightarrow{Ru} CH_4 + 2\,H_2O$$

⚠ **CAUTION**

When a purged methanator is installed, if the purge air supply of the Maxum II is interrupted during operation, it is imperative that the analyzer be powered down. Once powered down, the electronics enclosure door must be kept closed for at least 8 minutes. An 8-minute delay is necessary to give the methanator time to cool down sufficiently. If the door to the electronics enclosure is opened prematurely, explosive gas can ignite by entering the electronics enclosure and then entering the methanator through the conduit tube, causing equipment damage and injury.

⚠ **CAUTION**

In addition, any time the analyzer is powered down when explosive gases are present, it is necessary to wait at least 8 minutes in order to allow the purged methanator to cool before opening the analyzer door. Failure to observe these precautions may result equipment damage and injury.

⚠ **CAUTION**

For an explosion proof methanator, never remove the screw cap of the methanator while it is hot. If the cap is removed while hot, explosive gases can enter the device and ignite, causing equipment damage and injury. Allow at least 30 minutes for the methanator to cool down before opening.

Methanator Parts

The methanator is a stainless steel pipe filled with a catalyst. The pipe is heated using heating cartridges. An RTD temperature sensor regulates the heating. The pipe is heated to approximately 400°C, and the sample with hydrogen carrier is passed through the pipe. With the temperature and catalyst, the CO and/or CO_2 (depending on the exact temperature) are converted into methane for detection by the FID.

Because of the very high operating temperature, various safety protections are built into the design of the purged methanator. First, although the methanator assembly is installed in the detector compartment, it is installed inside a protective cover that limits air passage. The interior of the assembly is connected to the electronics enclosure using a conduit pipe which contains the electrical wiring for the methanator. This pipe and the protective cover over the assembly effectively make the interior assembly part of the purged electronics enclosure.

Further explosion protection features of the purged methanator include the gas inlets and outlets that enter and leave the methanator. These are configured as flame arrestors. In addition the protective cover that is installed over the methanator assembly is insulated to prevent the surface temperature from exceeding 180°C.

The explosion-proof methanator is protected by enclosing the hardware in an explosion-proof enclosure. Air passage is limited by sealed openings. Gas inlets and outlets are configured as flame arrestors. The device is insulated to prevent the surface temperature from becoming a hazard.

Specifications

	Non-Ex-Methanator	**Ex-Methanator**
Max. Operation Temperature	400 °C	400 °C
Heater	2 cartridges 115 V each	2 cartridges 115 V each
Classification	none	EEx dp IIB+H2 T3

Gas Supply

Use H_2 (35 to 45 ml/min) as carrier gas. H_2 is used as reaction gas in the methanator and as combustion gas in the FID. Combustion air and additive are adjusted the same as with the FID without methanator.

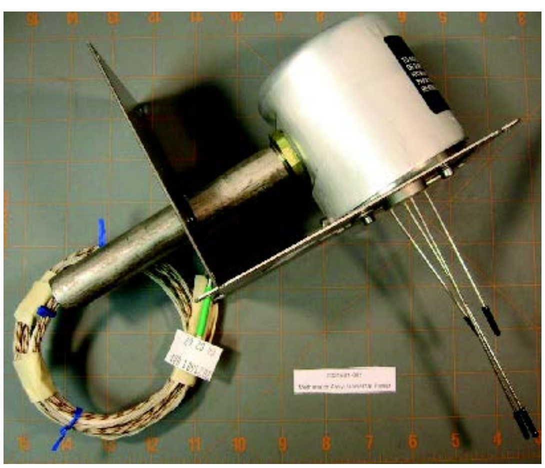


Figure 2-55 Purged Methanator

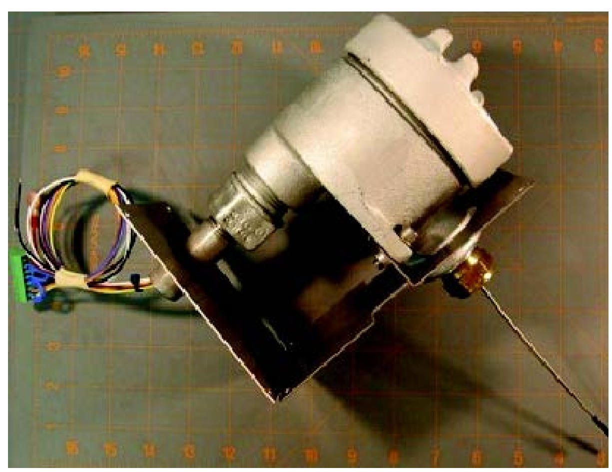


Figure 2-56 Explosion Proof Methanator

Thermal Conductivity Detector

Description

The Thermal Conductivity Detector (TCD) is a concentration responsive detector of moderate sensitivity. The detector cell, containing the sensing element, is an explosion-proof unit located in the chromatograph oven. The electronic circuits are located on a Detector Personality Module (DPM). (In older analyzers the DPM was mounted as part of an assembly with the SNE).

The detector works on the principle that the thermal conductivity of the carrier gas is different (conducts more heat or less from the heated element) than the thermal conductivity of the sample components. The electronic circuits sense the change in heat flow and produce a proportional analog voltage signal.

Sensing Elements

For varied applications the TCD can use either filaments or thermistors for its sensing element

Thermistor Model

8-cell Thermistor TCD: The detector includes six independent measurement cells and two reference cells. There is also a 4-cell version with three independent measurement cells and one reference cell. The 8-cell version has 4 installed thermistor boards and the 4-cell version has two thermistor boards installed. These two versions are otherwise identical. See the Intrinsically-Safe Thermal Conductivity DPM (IS-TCD3) on page 2-32 for a description of the DPM used for this.

Filament Model

For higher temperature requirements a 2-cell Filament TCD is available. The 2-cell Filament TCD can be used as an Inter-column Detector (ITC) in conjunction with a FPD or FID application. See the Base3 Detector Personality Module (DPM) on page 2- 27 for a description of the DPM used for this.

Measurement Principle

The TCD is operated in a constant temperature mode. The TCD compares the power required to maintain the measurement element (either thermistor or filament) at a specific temperature versus the power required to maintain the reference element at that same temperature. Thermistor detector beads operate at approximately 135 °C and filaments operate at approximately 325 °C.

Detector Gas Supply

Carrier Gas

Hydrogen, helium, nitrogen and argon are suitable carrier gases. In this sequence the thermal conductivity of the gases decreases. The TCD is most sensitive when the gas with the highest thermal conductivity difference is used. Table 2-9 below shows the thermal conductivity (at 300 ^{0}C) of various gases with reference to nitrogen.

Table 2-9
Relative Thermal Conductivity

Gas Type	Relative Thermal Conductivity at 300^0 C
H_2	675
He	560
CH_4	170
O_2	105
N_2	100
CO_2	90
Ar	70

Flow Rates

The flow rates through the reference branch and the measurement branch should be 1 to 40 mL/min each. For trace analyses the carrier gas should be selected such that the thermal conductivity difference is highest between the gas and the component of lowest concentration.

Pulse Discharge Detector (PDD) by Valco

Description

The Valco Model D-2 Pulse Discharge Detector (PDD) is manufactured by Valco Instrument Co. Inc. Three variations of the PDD are available for use in the Maxum II Process Chromatograph. These are Helium Ionization (PDHID), Photoionization (PDPID), and Electron Capture (PDECD). The PDD uses a stable, low powered, pulsed DC discharge in helium as an ionization source such that the need for a radioactive source is eliminated. Performance of the PDD is comparable to detectors with conventional radioactive sources.

In the helium ionization mode (PDHID), the PDD is a universal, non-destructive, high sensitivity detector. The response to both inorganic and organic compounds is linear over a wide range. Response to fixed gases is positive (increase in standing current), with a minimum detectable quantity (MDQ) in the low ppb range.

The PDD in helium photoionization (PDPID) mode is a selective detector. When the helium discharge gas is doped with a suitable noble gas, such as argon, krypton, or xenon (depending on the desired cutoff point), the PDD can function as a specific photoionization detector for selective determination of aliphatics, aromatics, amines, as well as other species such as ammonia.

In the electron capture mode (PDECD), the PDD is a selective detector for monitoring high electron affinity compounds such as refrigerants, chlorinated pesticides, and other halogen compounds. For this type of compound, the MDQ is at the femtogram (10^{-15}) or picogram (10^{-12}) level. The PDD is similar in sensitivity and response characteristics to a conventional radioactive ECD, and can be operated at temperatures up to 400°C.

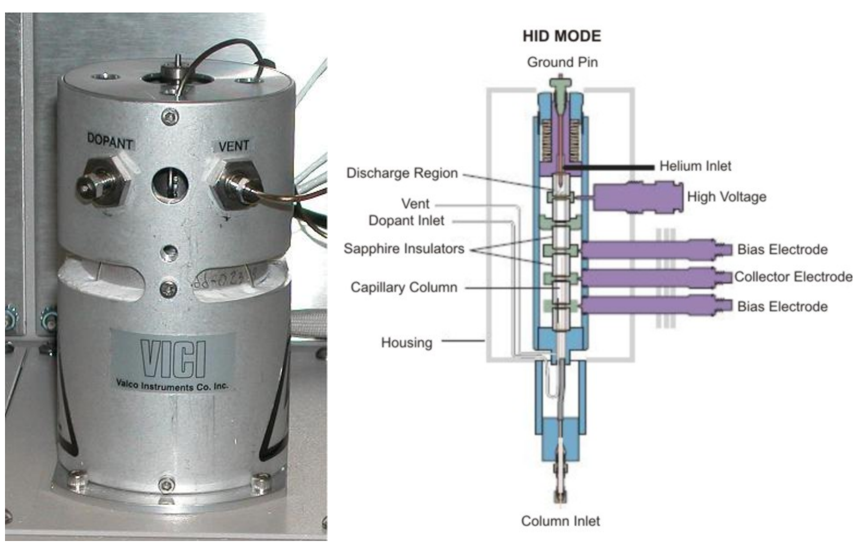


Figure 2-57 Valco Pulse Discharge Detector (PDD)

Measurement Principles

See the Pulse Discharge Detector (Models D-2 and D-2-I) Instruction Manual available from Valco Instruments Co. Inc. for information regarding the measurement principles of the Valco PDD in its different operating modes.

Specifications

Refer to the Pulse Discharge Detector Instruction Manual for complete specification information associated with the Valco PDD.

Operation and Installation

The electronics (Pulse Discharge Controller) of the Valco detector are used to control the pulse discharge and the detector temperature. The Valco electronics is also used to amplify the detector signal. The output of the Valco detector electronics is connected to the Maxum via a Base Detector Personality Module equipped with an Analog Input Mezzanine board. The processing of the Valco detector signal is then handled by the Maxum II electronics.

The Valco PDD should be operated in the 1X range with the Maxum detector board set on “low sensitivity”. The PDD 0-10V (un-attenuated) output from the Valco electronics is used.

The connection to the detector is critical. The column or a capillary tube must be inserted in the detector as noted in the Column Connection section of the Valco manual.

High purity gases together with a high quality gas purification device are required for proper use of the PDD. The quality of the gases is dependent upon the specific application. Refer to the Valco manual for general gas requirements and your custom documentation for specific requirements for your application. Normally an SAES Getters gas purifier is supplied with the system.

Refer to the Pulse Discharge Detector Instruction Manual for additional information regarding installation and operation of the Valco PDD.

Service

Service of the detector is limited to replacement of the electronics module or the replacement of the detector itself. Repair of these parts requires return to Siemens or Valco.

Live Tee Switch

Description

The live tee is a valveless switch that can be used in place of a valve for switching columns. The live tee is virtually maintenance free since it has no moving parts, no temperature limitations and the sample only comes into contact with metal parts in the Live Tee.

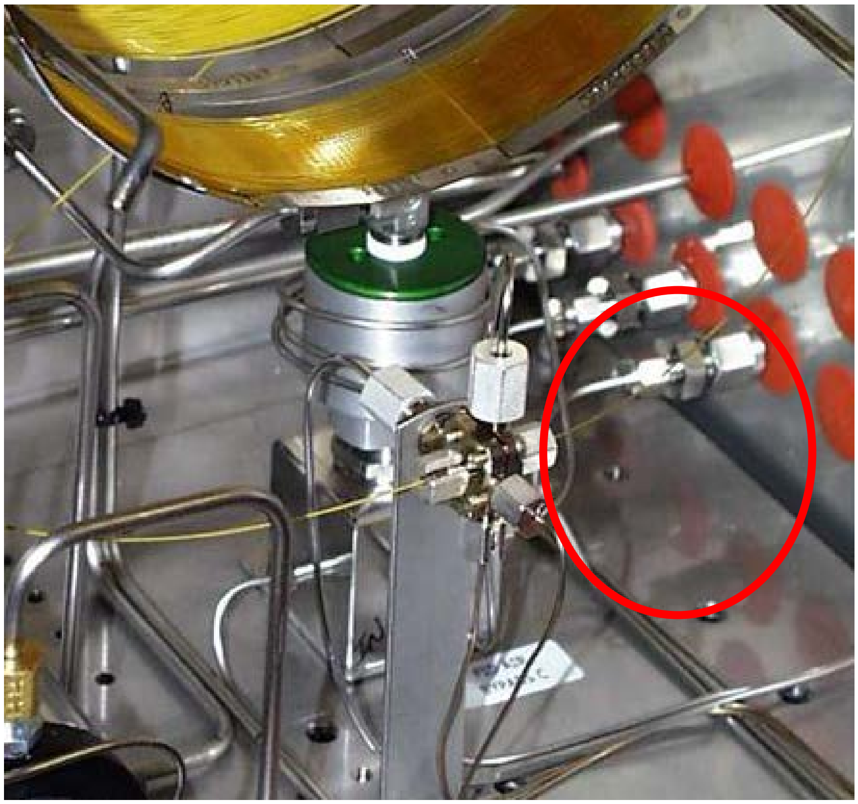


Figure 2-58 Live Tee Switch

Mechanical Description

There are two separate inner chambers separated by a polyamide barrier between the upstream column side (pre-column) and the down stream column side (main column). A platinum/iridium capillary tube (tee piece capillary) passes across the barrier. Columns are attached to the live tee by slipping the column end over the tee piece capillary all the way to the barrier, then backing out about 1 mm, and tightening a fitting using a metal sleeved graphite ferrule.

Exercise care to avoid puncturing the polyamide barrier or bending the capillary while installing columns. Follow the column manufacturer's instructions for cutting and handling fused silica columns.

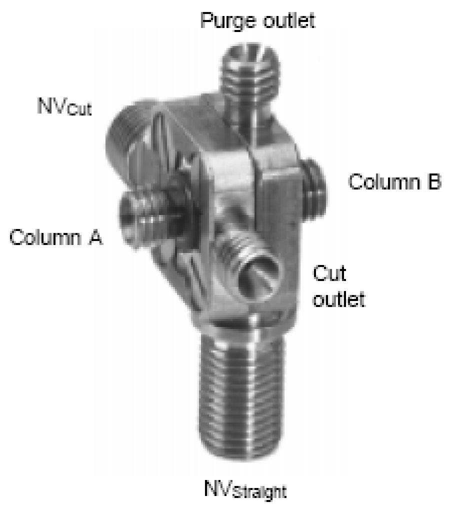


Figure 2-59 Live Tee Switch for Capillary Columns

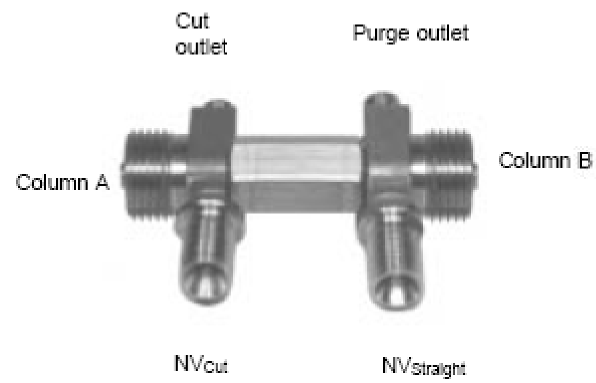


Figure 2-60 Live Tee Switch for Packed Columns

Inlets & Vents

The live tee has carrier gas inlets and vents on each of the upstream (Pm(+)) and downstream (Pm(-)) sides. The upstream side vent of the live tee is the heartcut vent (cut vent), and is normally run directly to atmospheric vent or through a monitor detector or ITC. The downstream side vent is called the “purge” vent and is normally connected to the outlet of the downstream column as a make-up or fuel gas just upstream of the main detector. During the flow set up procedure the purge vent can also function as an ITC when connected to the main detector. This is the typical arrangement of these vents. However, in some circumstances it is advantageous to plumb the cut vent to the main detector, and the purge vent to the ITC or directly to atmosphere. Figure 2-61 schematically shows the tee piece with columns and carrier gas connections.

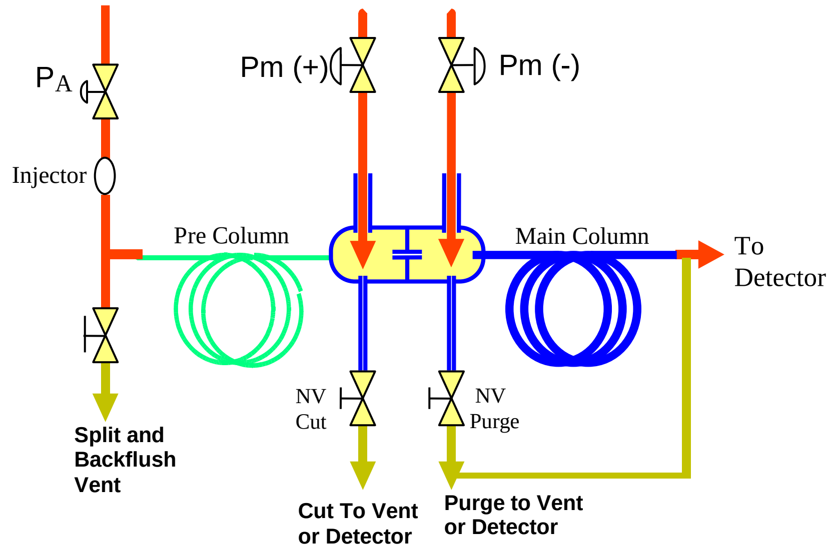


Figure 2-61 Typical Configuration

Operation

The following is a list of common terminology and abbreviations used in the following narrative.

Pa	Sample stream pressure at the inlet to the pre column.
Pm	Midpoint pressure. The pre-column outlet pressure of the sample stream at the Live Tee, as measured with the cut and purge vents (see below) blocked and the EPC flow through the carrier gas inlets off. This is the basis for determining the set point pressures for the carrier gas inlets, Pm(+) and Pm(-).
Pm (+)	Midpoint pressure set point for the upstream carrier gas inlet of the Live Tee.
Pm (-)	Midpoint pressure set point for the downstream carrier gas inlet of the Live Tee.
Cut Vent	Vent on the column inlet side of the tee piece, controlled by needle valve 1 (NV1)
Purge Vent	Vent on the column outlet side of the tee piece, controlled by NV2
Cut Off	Straight run flow pre column to main column (heartcut off)
Cut On	Pre column to cut vent (heartcut on)
Back Flush Off	Injector to pre column (opposite of the terminology used with valves)
Back Flush On	Pre column to backflush vent

How It Works

The operation of the Live tee takes advantage of the pressure drop across the tee-piece capillary and the annular spaces between the outside diameter of the capillary and the inside diameter of the column ends. The heartcut and backflush functions of the tee piece are delected by varying the pressures Pa, Pm(-) and Pm(+).

Straight Mode

To function in the straight-through column mode, pressure on the upstream carrier gas inlet (Pm(+)) of the live tee is set slightly higher than the pre-column outlet pressure (Pm). As shown below, this causes carrier gas entering the Pm(+) inlet of the tee piece to flow through the annular space between the column and the capillary and then through the capillary to the main column, adding a small component to the column flow. Pressure on the Pm(-) inlet of the tee piece is adjusted slightly higher than the pressure at the outlet of the capillary, but slightly lower than Pm(+), causing carrier gas to flow through the annular space between the main column and the capillary, adding another small element of flow to the main column. The small flows introduced to the column at both sides of the live tee effectively serve as make up flows, preventing any peak broadening through the tee piece by eliminating unswept dead volumes.

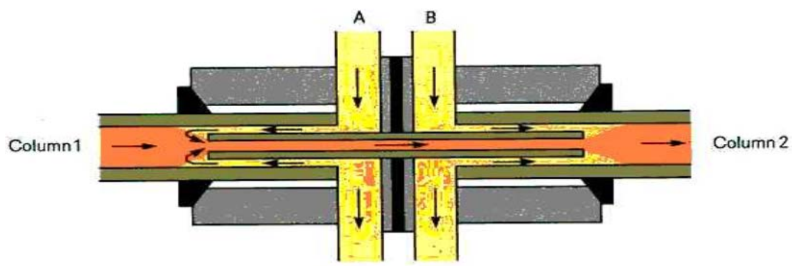


Figure 2-62 Straight – P_a > Pm(+) > Pm(-)

Cut On Mode

To function in the heartcut mode, as shown below, the pressure at Pm(+) is reduced to slightly below that of Pm(-), causing carrier gas to flow from the Pm(-) side back through the capillary and out to the cut vent, taking with it all flow from the pre-column. It is possible to have this pressure adjusted marginally so peaks are split and flow to both the main detector and out to the cut vent. It is also possible to have the Pm(-) pressure adjusted so peaks partially flow through both the main detector and the purge vent. When either of the two vents is connected to the main detector at the outlet of the main column, the earlier eluting peaks from the vents signal the peak retention time of the pre-column and are useful in determining cut timing.

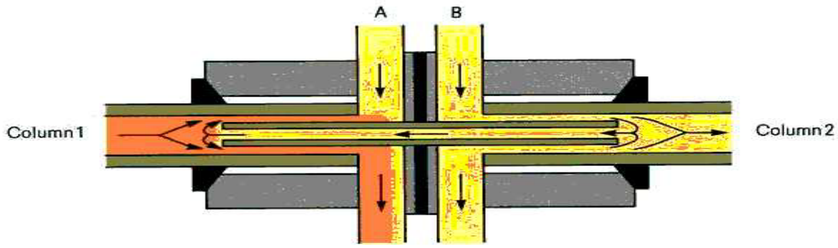


Figure 2-63 Cut On – P_a > Pm(-) > Pm(+)

Backflush Mode

To function in the backflush mode, shown below, pressure at the column inlet Pa is reduced to allow flow of carrier gas from the Pm(+) side of the live tee back through the pre-column and out the backflush vent. The splitter vent will usually double as a backflush vent, but in the case of direct injection, a pneumatic valve can be opened when inlet pressure is reduced. In this mode, Pm(+) is also slightly higher than Pm(-), causing carrier gas to flow through the capillary and out to the downstream column as shown below.

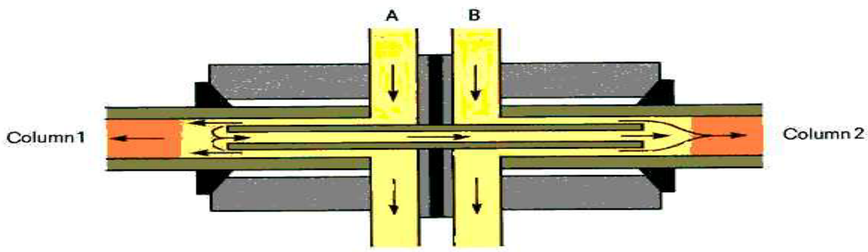


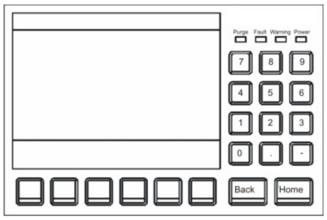
Figure 2-64 Backflush – Pm(+) > Pm(-) > Pa

Chapter 3

Operation of Maxum II User Display Panels

Overview

Introduction



This chapter is intended for operating and maintenance personnel.

Two different versions of user display panel are available for the Maxum. The original version is the HMI, also referred to as a Maintenance Panel. This user interface featured a black and white screen and keypad entry. A newer display is also available, the Color Touchscreen Display (CTD). This enhanced interface features a touch screen and color display, with a larger screen than the HMI. Both types of display are installed in the door of the Maxum analyzer.

All of the Maxum II's operational and daily routine maintenance tasks can be performed from either the HMI or from the CTD.

See subchapter 3a for information relating to the CTD. See subchapter 3b for information relating to the HMI.

Chapter 3a

Color Touchscreen Display Panel Operation

Overview

Introduction

This chapter is intended for operating and maintenance personnel.

All of the Maxum II's operational and daily routine maintenance tasks can be performed from the Color Touch Screen Display (CTD). Two different hardware configurations are supplied for the CTD. The operation of the two doors is identical.

The latest door hardware, supplied in the Maxum II analyzers equipped with single or dual airbath and airless ovens, is called the "TIB Door". The door has the touch interface mounted on the back of the display panel itself, with LCD control and backlight power cabled from the SYSCON2.1.

TIB Door

The "CIM Door", currently supplied in the Maxum II Modular Oven analyzers, is controlled by a processor board called the CIM Board. The combination of board and display is referred to as the CIM (Control Interface Module). Information relating to the Control Interface Module hardware can be found in the Maintenance Manual for the Maxum II Modular Oven Configuration (Siemens Part Number A5E31405710001).

CIM Door

The CTD runs an enhanced version of the HMI software that is used to control the Maintenance Panel in older versions of Maxum. Because this chapter deals primarily with the operation of the software, the term HMI may be used at times to refer to the software even though the hardware is the CTD or CTD Display. In addition, the display emulator in the workstation software is referred to as the HMI emulator.

The HMI software on the CTD utilizes interactive display screens, menus, and icons for common functions. In addition, the software is equipped with context sensitive help for most functions. This makes the device intuitive and simple to use once the user is familiar with the basic operation.

Before You Begin

The information in this chapter is written for the color touch screen Display running the latest software version. Some versions of Maxum may be equipped with the older Maintenance Panel. Information for that version of the Maintenance Panel can be found chapter 3a of this manual.

Since it is also possible to install a CTD display in an existing Maxum (including Airbath/Airless oven configuration), it may be possible that the CTD has a different software version. In this case some screens and menus may appear different.

However, all versions of display are designed to look and operate in a similar manner, including both the CTD Display and the Maintenance Panel running the most recent software versions. All versions 4.0 and up have a menu tree of the HMI that is organized into 3 functional levels. These levels allow different levels of access to analyzer control and configuration.

Emulator

A PC-based graphical simulation of the physical CTD, known as the HMI emulator, is available using the PC based workstation software. This emulator is capable of performing all of the functions that are available with the physical unit. The emulator is a graphical representation of the physical display. Because of this, some aspects of the emulator appear slightly different than they appear on the physical unit.

Chapter Highlights

Color Touchscreen Display Hardware

Overview

The CTD contains a back-lit color graphic display screen layered with a touch screen sensor.

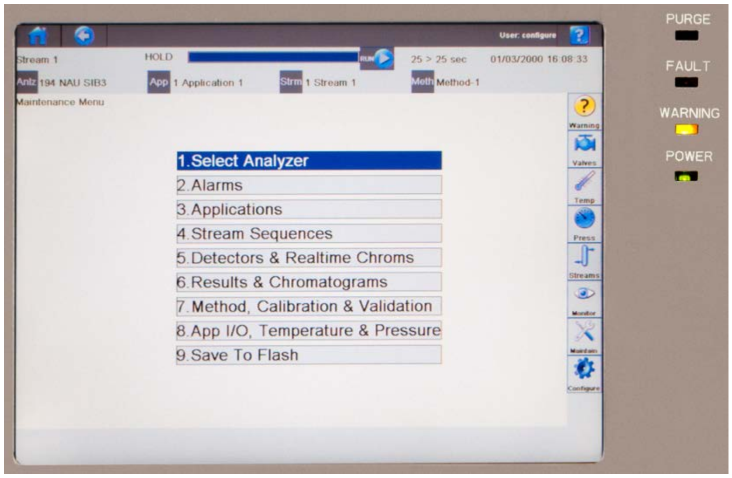


Figure 3-1: CTD

Status LEDs

The four LEDs next to the screen indicate the analyzer systems status.

Power	Power	The green "Power" LED lights when the power supply is on.
Warning	Warning	The yellow "Warning" LED lights when the "Maintenance request" status signal is active.
Fault	Fault	The red "Fault" LED lights when the "Failure" status signal is active.
Purge	Purge	The red "Purge" LED lights when purge pressure is lost as detected by the PECM-DC.

Screen Characteristics

Description

The screen is in color and back-lit for easy reading, and it is divided into several functional areas:

- Main Navigation Bar
- Status Bar
- Content Area
- Toolbar
- Softkey Bar

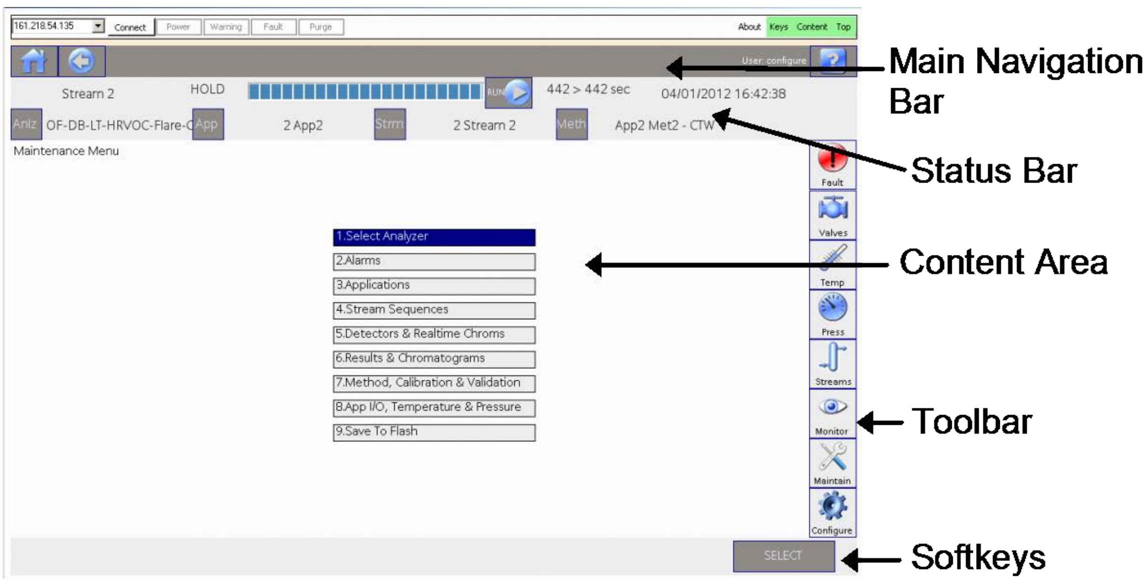


Figure 3-2: Screen Layout

Main Navigation Bar

The main navigation bar allows the user to return to the home menu screen, go back to a previous menu screen, or launch the interactive help function (all denoted by easy to understand icons).

The help function on the main navigation bar is an interactive feature that provides context sensitive assistance. It is accessed by clicking the help icon on the far upper right and then clicking the area of the screen for which help is desired.

The main navigation bar also contains information regarding the current level of password access (default is “configure”). This information is located next to the help icon in the far right side of the bar.

Status Bar

The status bar shows various data about the analyzer, including the name, date and time, and run/hold status. It also shows information about the current application, stream, method, and cycle clock. In addition, the status bar contains gray buttons that permit the user to change the run/hold status or to select the current analyzer, stream, application, and method.

Content Area

The middle part of the screen is the general content area. It contains menu lists or parameters with the applicable values, as well as alarm messages and operator hints. The content area is where the primary information for a selected screen is displayed. The top left of the content area is usually a general name or description of the screen.

Toolbar

The toolbar allows the user to navigate directly to commonly used screens. This includes access to the alarm screen as well as settings for valves, temperature, pressure and streams. It also allows the user to navigate to the different menu levels (monitor, maintenance, and configure).

The Softkey Bar

The softkey bar appears at the lower edge of the screen. Its gray background distinguishes it from the content area. The softkey bar associates different actions with the softkeys located below the screen. The actions vary depending on the screen shown.

Using the CTD

Navigating the Menus

As mentioned previously, the menu tree of the CTD is organized into three functional levels. This structure is used to allow different levels of access to analyzer control and configuration operations. The three functional menu levels are as follows.

- Monitor Menu – This menu level allows minimal control of the analyzer and viewing of analyzer status with minimal control of analyzer function. This level is intended for operations personnel. All password levels have access to the Monitor Menu; however, higher access is necessary for some functions.

- Maintenance Menu – This menu level allows detailed application and stream control and is intended for engineering personnel. A password with “Maintain” level access is needed to access the Maintenance Menu and all of its functions.

- Configure Menu – This menu level allows system configuration control and is intended for use of system administrators and engineers. A password with “Configure” level access is needed to access the Maintenance Menu. Higher (“Super”) access is needed to access user and password functions.

These different menu levels can be selected using the tool bar icons. The three options show up anytime any one of the main three menus is displayed. Select the Home icon in the far upper right corner of the CTD in order to display the default menu, which will display the menu icons.

The Toolbar

The toolbar allows the user to navigate directly to commonly used screens. In addition to selections described above, this includes access to the alarm screen as well as settings for valves, temperature, pressure and streams. To navigate to a screen using the toolbar, simply tap on the desired icon (or click if using the HMI emulator).

The Softkey Bar

At the bottom of the screen, below the content area, is the softkey bar. When a menu is displayed, a series of softkeys appears on the softkey bar. As the user navigates through the different screens, the softkeys that appear will depend on the particular screen being displayed. The function of each softkey is identified by a label on the softkey.

To operate a softkey, simply touch it on the display screen (or click on it if using the HMI emulator).

Entry of Data

The original Maintenance Panel for Maxum was equipped with a numeric keypad for data entry. The touch screen function of the CTD eliminates the need for this. When data entry is required on the physical CTD, a pop-up window with numeric keypad appears on the screen as shown below.

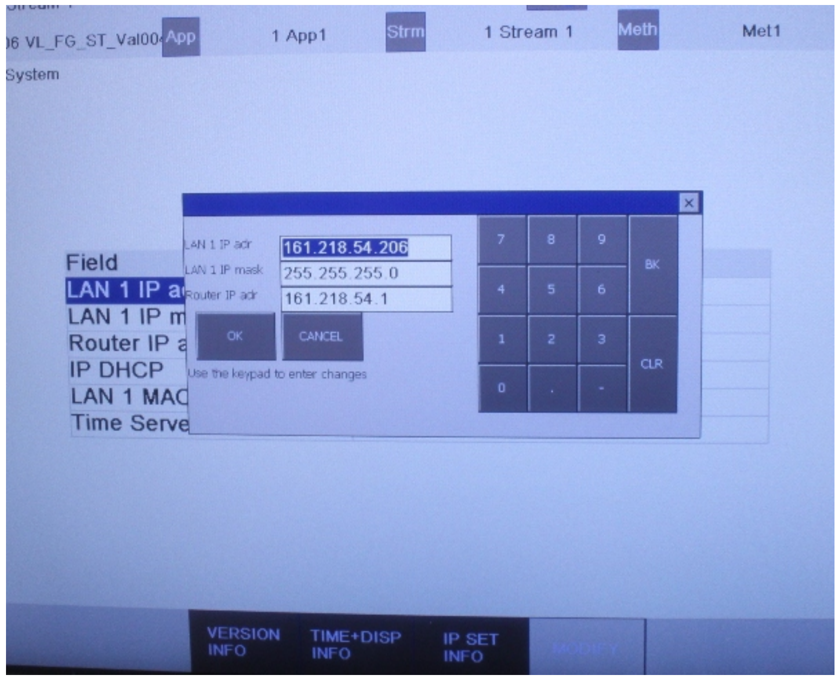


Figure 3-3: Window for Data Entry on CTD

When the HMI emulator is used, the data entry window does not appear because the numeric keys on the computer keyboard can be used.

Accessing Help

The online help function of the CTD represents a large leap forward in usability over the original HMI. It allows the user to obtain a help description for virtually every element displayed on the screen. It also allows the user to obtain detailed descriptions of alarms as well as possible causes and suggested corrective actions.

Context Sensitive Screen Help

To access help touch the help icon ( ) on the upper right corner of the CTD (or click on the icon if using the emulator). This puts the software in an interactive help mode. This mode is context sensitive. This means that for the next item you touch (or click), the software will display a help window for that item.

In the figure below, the help icon was selected and then the “Temp” icon on the toolbar. This displayed the help text window in the middle of the screen.

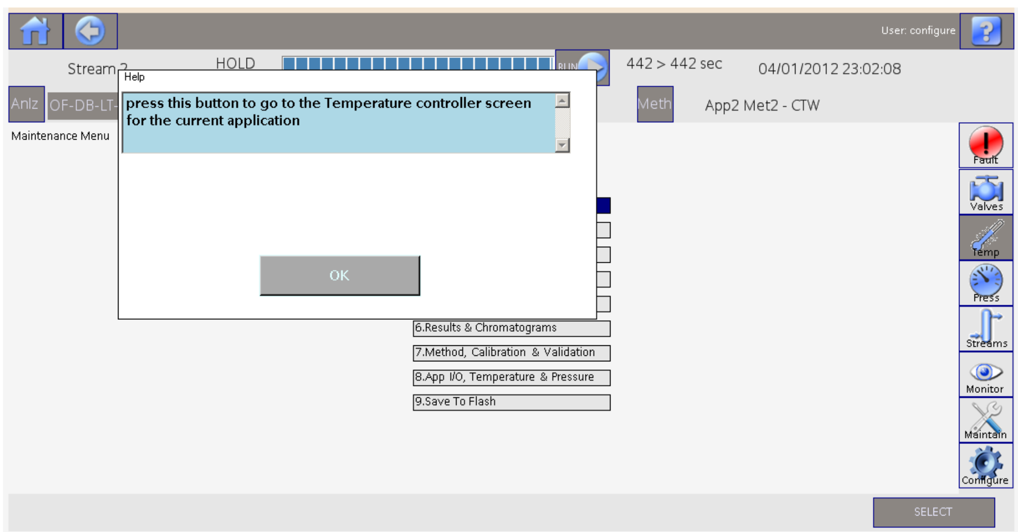


Figure 3-4: Window for Data Entry on CTD

Click OK to remove the window and continue. Note that once the window is removed, the software is no longer in the help mode. Clicking a selection will have the normal effect.

Alarm Help

One useful feature of the online help function of the CTD is the ability to get detailed descriptions of alarms as well as possible causes and suggested corrective actions.

To access alarm help, first load the alarm screen by selecting it from the menu or from the toolbar on the right side of the screen. Next, touch the help icon ( ) on the upper right corner of the CTD (or click on the icon if using the emulator). This puts the software in the interactive help mode. To see help for an alarm, click the “Description” field for that alarm. This will display the alarm help screen.

In the figure below, the help icon was selected and then the “Description” field for the first alarm on the list. This displayed the help text window in the middle of the screen.

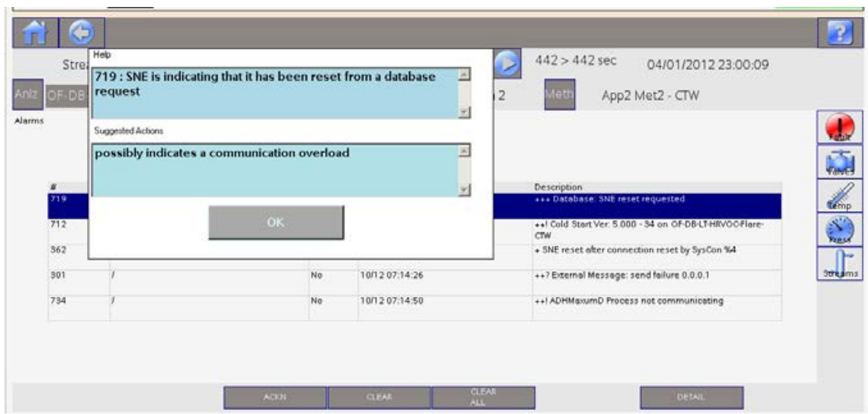


Figure 3-4: Window for Data Entry on CTD

Note that this help box is displayed only when the “Description” field is selected while in help mode. Selecting other fields for the alarm provides help information describing what the field is used for (context sensitive help described on the previous page), rather than information about the alarm.

Password Restrictions

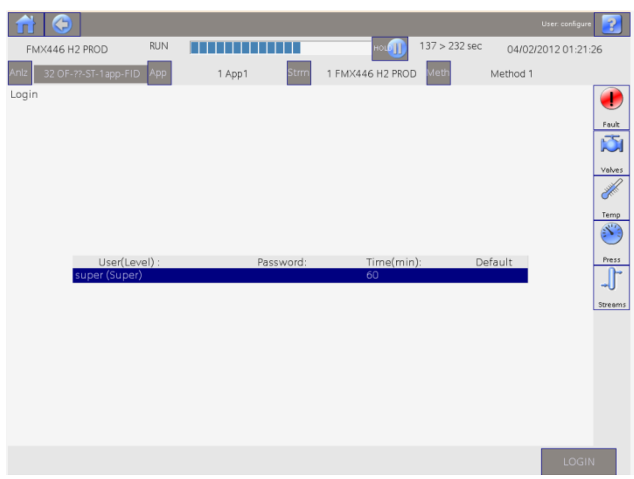
Description

It is possible to configure the CTD for different levels of password access. By default, six different levels of password access are available. By default, the display is preset for a “configure” level of access, which allows the user to perform almost all analyzer functions except password administration. If the access level of the current active password is not sufficient for a requested operation, a screen will appear stating that the required level of password must be entered. By default, when a password is entered, the session remains active for 60 minutes unless a different time period has been set; see description of “SET TIME” softkey below.

Checking Your Access

To see if you are authorized to perform a specific function, use the appropriate menu path to navigate to that function.

If the following screen appears, then password entry is necessary to perform that function (i.e. the current level of access is not sufficient to perform the function). Select the “LOGIN” softkey and then enter the appropriate password and press OK. If the password is correct and has sufficient access, access level will change (seen in the upper right corner of the display next to the help icon). You are now logged on and can execute the required function. If the password is incorrect, the screen will revert back to the home menu and the access level will not change.



Password Format

A password consists of one to six numerical digits and is entered via the numeric keypad.

Obtaining/Changing a Password

Passwords can be modified from the User's Passwords screen on the Configure menu. To change a password you must be logged on with "Super" level access. To change a password, select the table entry for the user and then tap (click) the "SELECT" softkey. This will display a window to modify the password.

Privilege

If your password is accepted you can modify any menu items or parameters assigned to your user level (or lower user levels). There are six predefined user levels (levels 0-4 and 99). The items that can be modified at these user levels are predefined and cannot be changed by the user.

By default six users are defined. These are "public", "operate", "calibrate", "maintain", "configure", and "super". The default access level for each of these users matches their names. In addition, multiple individual users may be defined. These users must have unique names and they can be created with either "operate", "calibrate", "maintain", or "configure" access levels. Creation and deletion of users must be performed using the workstation software. (Refer to the Gas Chromatograph Portal (GCP) chapter of this manual for instructions on creating and deleting users).

The change privilege remains in effect if the user presses any key before the timeout limit (default 60 minutes). In this manner the user does not have to re-enter a password repeatedly while browsing through menu screens. However, the analyzer automatically logs out (back to the default user), if the user has not pressed a key within the timeout limit.

Chapter 4

Maintenance

Overview

Description

Procedures in this Chapter are for use by maintenance personnel.

Note: Some hardware modules have been updated. See Chapter 2 for information on the latest hardware.

Safety First

When performing maintenance procedures in this chapter observe all warnings, cautions and notes to prevent physical injury to yourself or unnecessary damage to the equipment.

WARNING

⚠

Observe all plant safety requirements before performing any repair or maintenance on the Maxum II.

Chapter Highlights

The following maintenance information is provided:

Help

If technical assistance is required during performance of maintenance functions, or if parts are being returned, the customer should contact Siemens at the addresses and/or phone numbers provided at the beginning of this manual.

How to Use This Chapter

Before performing a procedure first read it through. It is recommended that a regular scheduled daily, weekly or monthly maintenance program be established. By doing so, the Maxum II's downtime will be reduced and the system will operate at optimum analytical efficiency. Siemens recommendations for routine maintenance are listed in table 4-1 on the following page. These recommendations are intended as a guideline. Actual maintenance may change depending on application and the environment in which the Maxum II operates.

Overview, Continued

Note: The tasks described below are provided as a suggested guidleine for routine maintenance. Requirements for a particular analyzer will depend on environment, location of the analyzer, available resources, and the specific characteristics of the application.

Task	Frequency
Backup of database	Weekly as well as before performing any maintenance that requires the analyzer to be powered down.
Status Check – Includes checking alarms, utility bottle pressures, flow rates, and oven temperature.	Daily.
Visual Inspection (walk by)	Daily or weekly (may vary depending on location, application and. environment)
Interior Electronic Enclosure Visual Inspection (open cabinet and check for moisture and/or contamination)	Monthly (may vary depending on location, application and environment)
Valve Inspection	Gas Samples – Model 11 – 6 months Model 20 – 6 months Model 50 – Yearly Liquid Injection Samples - All valve types 6 weeks Routine maintenance schedule for valves will vary greatly depending on sample properties, application (including temperature and pressure) and environment. In addition, for liquid injection applications, valve seals may need to be replaced on a regular basis. The interval could range from 4 weeks to a few months depending on the sample properties.

Table 4-1: Recommended Routine Maintenance

Note: The tasks described below are provided as a suggested guidleine for routine maintenance. Requirements for a particular analyzer will depend on environment, location of the analyzer, available resources, and the specific characteristics of the application.

Task	Frequency
Verification of Calibration	Monthly (may vary greatly depending on application). When validation is included automatically as part of the method, the results should be checked daily if possible.
Sample Transport Filters	Replace as necessary. Note that wet/dirty samples require more frequent attention than dry/clean samples.
Lithium Battery on SYSCON	Replace every 5 years

Table 4-1 (Continued): Recommended Routine Maintenance

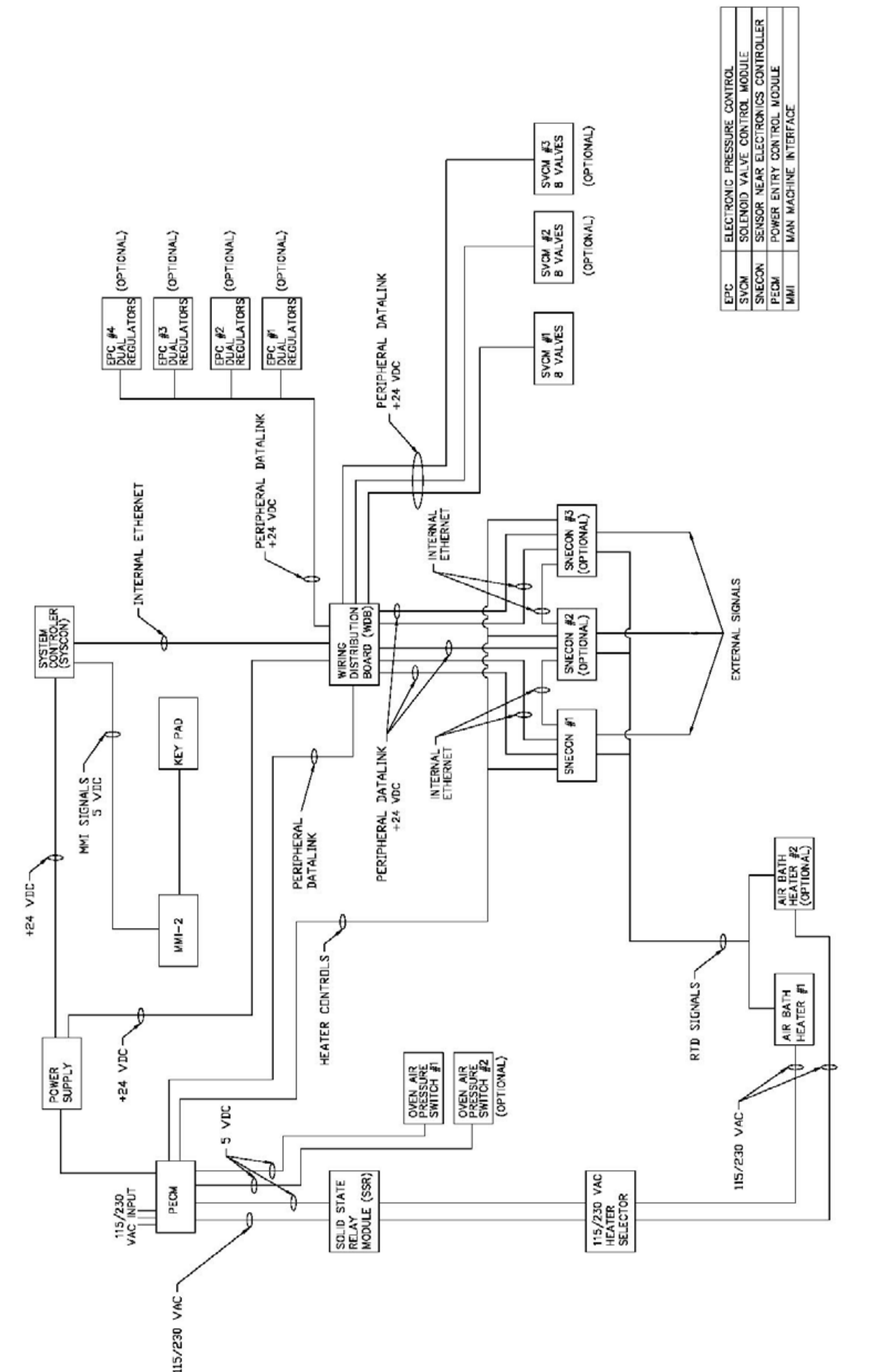


Figure 4-1: Electronics Enclosure Wiring Harness Diagram

General Maintenance

Scheduled Maintenance

It is important that a preventative maintenance schedule be established to examine the Maxum II for internal and external cleanliness, damage, and proper operation. Refer to Table 4-1 for suggestions regarding maintenance intervals. However, maintenance schedules for a particular analyzer will depend on the application, operating environment, maintenance resources, and geographical location of the analyzer.

Even though the Maxum II is tightly sealed against moisture and foreign contamination, it is recommended that the electronic enclosure door be opened periodically and internal components examined for moisture and/or contamination. If contamination is found, the system should be shutdown and corrective procedures performed. If such contamination is not removed, it could render the Maxum II inoperable.

Component Interface Cabling and Connectors

Modular components within the Maxum II are interfaced together via miniature ribbon cables, miniature wiring and connectors. It is therefore important that maintenance personnel follow the information presented in the following sections to prevent their damage.

Ribbon Cable

Therefore, when opening and closing electronic enclosure door for maintenance and/or inspection, care must be exercised so as not to place a sharp bend or crimp in the cable when the door is closed.

Removing Connectors

Internal components and modules are interfaced together using miniature wiring and associated connectors. It is therefore important that when a module and/or component is to be removed and replaced, that the connector be grasped and gently rocked, back and forth. **DO NOT REMOVE A CONNECTOR BY PULLING ON ASSOCIATED CONNECTOR WIRING.**

Nut and Bolt Mounting Hardware

With very few exceptions, nut and bolt hardware used to secure modules and/or components in their mounting locations are in metric.

WARNING

Observe all plant safety requirements before performing any repair or maintenance on the Maxum II.

Opening Doors

To gain access to the modules, the electronic enclosure door must be opened. It will be necessary to use a #4mm Allen wrench to open the door if the Allen screw on the latch has been tightened.

APU Maintenance Switch

When an analyzer is equipped with an Automatic Purge Unit (APU), the APU is designed to cut power to the analyzer when the Electronics Enclosure Door is opened (disrupting purge). Maxum II analyzers with APU are equipped with a key operated Maintenance Switch that allows a user to perform maintenance on the analyzer while powered.

WARNING ⚠

The Maintenance Switch on a Maxum II analyzer that is equipped with Automatic Purge Unit (APU) should ONLY be used when it has been verified that the analyzer location is safe. "Hot Work" permits may be required depending on the location. All work must be with the approval of local safety personnel.

Inspection After Maintenance

After performing any maintenance function(s), check to be certain there is no loose hardware left within the electronic enclosure. Such items can create electrical shorts causing damage to internal components. This increases system downtime for performing of corrective maintenance.

Field Tool Kit

Recommended tools for performing maintenance are as follows:

- Maxum II Tool Kit

or

- Set of metric Allen wrenches
- Set of metric wrenches or nut drivers

Note: Special tools required for specific procedures within this section are noted within the procedure (example: torque wrenches required for valve assembly).

Use of Solvents and Detergents

It is important for proper procedures to be used when cleaning valve and detector parts. All foreign contamination adhering to the part should be removed using an appropriate cleaning solvent, such as hexane, acetone, or methanol and a dust/lint free cloth. Use of an ultrasonic cleaner is often helpful. After cleaning, it is necessary remove excess cleaning fluid from the components by blowing with clean air or shaking. Components must be air dry before reassembling.

It is also possible and often better to use an appropriate detergent, such as Alconox® for cleaning instead of solvent. However, after cleaning with a detergent, it is necessary to rinse the part thoroughly with deionized water (distilled water is also acceptable) in order to remove detergent residue. All water must then be removed by blowing with clean air or shaking. Components must be completely dry before reassembling.

SYSCON2

Description

This section presents the procedures for removal or installation of the SYSCON2 boards, SIB and CAC3. The SYSCON2 is mounted in the upper center section of the electronic enclosure with the SIB being mounted within the bottom of the SYSCON cage and the CAC3 being mounted on the SIB.

- CAC3 Removal and Installation
- SIB Removal and Installation
- Battery Replacement

NOTE

The steps to install expansion boards in the SYSCON2 are the same as for the legacy SYSCON. The procedure for installation of expansion boards is detailed in the previous section

WARNING

Voltage dangerous to life exists. Before performing the removal and installation procedures, it is important that primary AC power to the Maxum II be turned off from the main circuit breaker. Observe all plant safety requirements before performing any repair or maintenance on the Maxum II.

CAUTION

To remove the SIB from the SYSCON assembly, the assembly must be completely removed from the electronic enclosure. When removing the assembly, exercise care so as not to drop the assembly. Doing so could seriously damage sensitive components. When removing any SYSCON2 components, service personnel should either wear a wrist type grounding strap with the other end connected to the SYSCON frame or personally ground themselves to the chassis. Even a small static discharge could cause permanent damage to the sensitive electronic components.

Procedures

The following procedures should be followed for removal and installation SYSCON2 related hardware.

CAC3 Removal and Installation

Step	Procedure
1.	Before beginning replacement, if possible, save the current Maxum .amd database file to be reloaded after the CAC3 board is replaced. Note that if the CAC3 is faulty, backup may not function. In this case it will be necessary to use the most recent backup file.
2.	Once the database is saved, power off the Maxum.
3.	Open electronic enclosure door (using a 4mm (5/32”) Allen wrench if necessary). When door is open **DO NOT** place tension on the Maintenance Panel interface ribbon cable.

Step	Procedure
4.	Using a 5/16” wrench or Phillips screwdriver (depending on assembly type), loosen the topmost SYSCON assembly fastening nuts that secure the assembly to electronic enclosure mounting bracket.
5.	Pull the SYSCON assembly cage forward so it rests on the rubber mounting foot, being careful not to damage any connected cables. Refer to figure 4-7

NOTE

In the following step only remove expansion boards that would prevent removal of the CAC3 board. Verify each expansion board interface cable is labeled with its mounting location.

6.	If boards are installed in the PCI slots that block removal of the CAC3, those boards must be unplugged at this time. Disconnect interface cables for any board that must be removed and then remove the board (make note of which cables are connected to which board before removing).

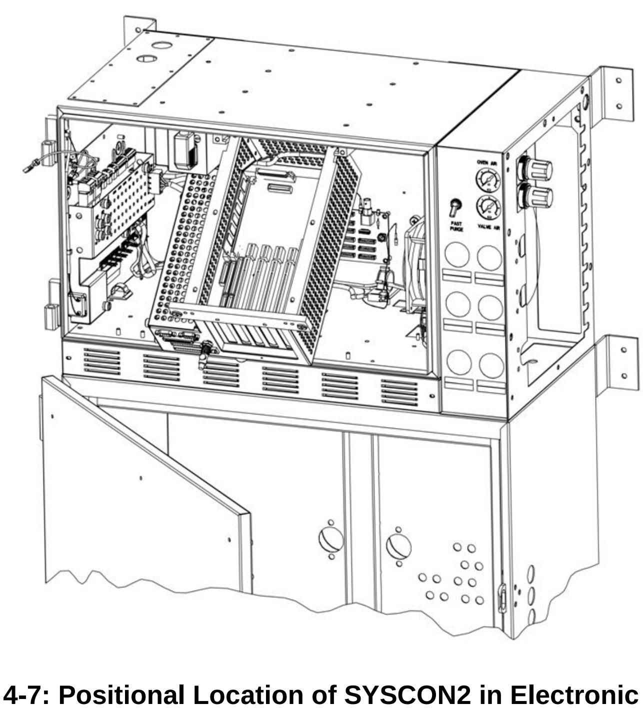


Figure 4-7: Positional Location of SYSCON2 in Electronic Enclosure

Step	Procedure
7.	Disconnect the Ethernet cable from the CAC3 board. It is not necessary to disconnect the other end of this cable.
8.	Remove the CAC3 board by grasping both sides firmly and pulling up. Do not touch board mounted components.
9.	Place the CAC3 in an anti-static bag for return to Siemens.
10.	Install the new CAC3 board by pressing it firmly into the connectors, taking care not to touch any components or connections on the board. Then, reconnect the Ethernet cable to the CAC3.
11.	If any boards were removed from PCI slots, reinstall them at this time and reconnect their cables. Verify that all boards and cables are in their correct locations.
12.	Repeat previous steps in reverse order to slide the SYSCON assembly cage back into place, tighten the fastening nuts, and close the analyzer door.
13.	Apply power to the Maxum and allow it to boot.
14.	Restore the analyzer database using the .amd file that was saved before beginning the procedure.
15.	When the CAC3 is removed, current date and time information is lost. If the analyzer is configured to obtain date and time information from a central server, then it will update automatically. If no time server is set, it will be necessary to manually set the date and time on the analyzer.

SIB Removal and Installation

Step	Procedure
1.	Before beginning replacement, if possible, save the current Maxum .amd database file. Note that if the SIB is faulty, backup may not fuction.
2.	Once the database is saved, power off the Maxum.
3.	Open electronic enclosure door (using a 4mm (5/32") Allen wrench if necessary). When door is open **DO NOT** place tension on the Maintenance Panel interface ribbon cable.
4.	Using a 5/16" wrench or Phillips screwdriver (depending on assembly type), loosen the topmost SYSCON assembly fastening nuts that secure the assembly to electronic enclosure mounting bracket.
5.	Pull the SYSCON assembly tray forward so it rests on the rubber mounting foot, being careful not to damage any connected cables.
6.	Pull the SYSCON assembly cage forward so it rests on the rubber mounting foot, being careful not to damage any connected cables. Refer back to figure 4-7 in the previous procedure.
7.	Note the connection locations of all interface cables, labeling them if necessary. Then unplug each external interface cable. This includes any cables connecting to boards in the PCI slots, any serial cables, HMI ribbon cable, and any external Ethernet cables (including the Ethernet cable running to the SNECON). Any orange I/O connectors should be labeled and unplugged from their respective locations (do not disconnect the I/O wiring from the connectors).
8.	From rear left side of the SYSCON cage, remove the two external PECM Power Cables. To remove cables, press in the connector locking tabs and pull connector outward. These two cables have different connectors preventing cabling errors during reinstallation.

SYSCON2, Continued

Step	Procedure
7.	Remove the SYSCON cage tray by lifting the tray upwards and pull forward from its mounting rail assembly. It is recommended that the assembly be lifted by one hand and supported by the other. Place assembly on a clean dirt free work surface.
8.	The oldest version of SYSCON assembly tray must be partially disassembled in order to remove the SIB board. This version of tray can be identified by the perforated panels that surround it. If this type of assembly is in use, remove the perforated panel on the left side of the tray as shown in the picture below. If this type of tray is not in use, skip to the next step.

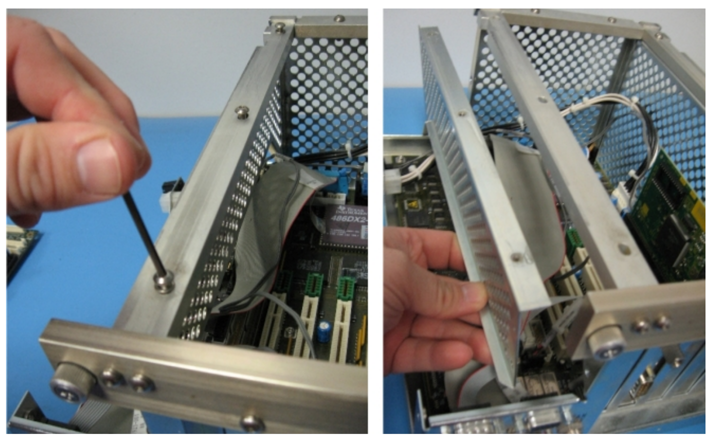


Figure 4-8: Partial Disassembly of Original Version SYSCON tray

9.	Note the locations of any boards mounted in the PCI slots and any cables connected internally to the SIB board. Temporarily label cables and boards if necessary.
10.	Remove any boards that are plugged into the PCI slots of the SIB. Also, disconnect the internal Ethernet cable and remove the Ethernet Switch board from the far right slot. Set Ethernet Switch and any other installed boards on a clean dry surface.
11.	Remove all internal cables that are connected to the SIB. The plug in locations of these cables should have been noted in the previous steps.

Step	Procedure
12.	Remove the CAC3 board by grasping both sides firmly and pulling up. Do not touch board mounted components. Set the CAC3 aside on a clean dry surface.
13.	Remove the six Allen screws that secure the SIB to the SYSCON assembly tray. Screws are located in each corner and in the center of the SIB.
14.	To remove the SIB, lift-up the right side and carefully slide the board out the right side of the SYSCON assembly. Carefully guide the SIB over and around any connector hardware that is attached to the inside of the SYSCON assembly. When removing motherboard, lift by the board by the edges. DO NOT touch board mounted components.
15.	Place the SIB in an anti-static bag for return to Siemens.
16.	To reinstall new SIB, repeat previous steps in reverse order. When reinstalling CAC3 board and any other electronic boards, handle by the edges to prevent damage to components.
17.	Verify that all hardware is installed securely and in the correct locations.
18.	Reinsert the SYSCON assembly tray into the analyzer and leave it in the pulled-out dropped-down position.
19.	Reconnect all external cables to their correct locations. Verify that all connections are secure and correct.
20.	Slide the SYSCON assembly cage back into place, tighten the fastening nuts, and close the analyzer door. Then, apply power to the Maxum analyzer and allow it to boot.
21.	Since the CAC3 board was not replaced, it should NOT be necessary to reload the analyzer database.
22.	When the CAC3 is disconnected from the SIB, current date and time information is lost. If the analyzer is configured to obtain date and time information from a central server, then it will update automatically. If no time server is set, it will be necessary to manually set the date and time on the analyzer.

IMPORTANT

The battery should only be replaced with an approved spare. Contact Siemens for a replacement.

Battery Replacement

Step	Procedure
1.	Open electronic enclosure door (using a 4mm (5/32") Allen wrench if necessary). When door is open **DO NOT** place tension on the Maintenance Panel interface ribbon cable.
2.	Using appropriate tools, loosen the topmost SYSCON Assembly fastening hardware that secures the assembly to electronic enclosure mounting bracket.
3.	Pull the SYSCON assembly forward and lower so it rests on the electronic enclosure bottom frame rubber mounting feet. For battery location, refer to Figure 4-9.
4.	Remove defective battery from its mounting bracket located at the rear of the module. Refer to picture below.
5.	When installing Lithium Battery in its holder, place the positive (+) side so it installs per marking on the holder.
6.	After installation, push the SYSCON assembly back into its mounting facility and secure assembly in place with the fastening hardware.
7.	Before closing door and reapplying AC power, be certain the battery is securely installed in its holder and polarity, within holder, is correct.
8.	When the battery is disconnected, current date and time information is lost. If the analyzer is configured to obtain date and time information from a central server, then it will update automatically. If no time server is set, it will be necessary to manually set the date and time on the analyzer.

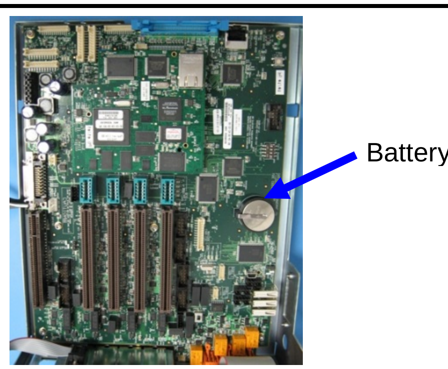


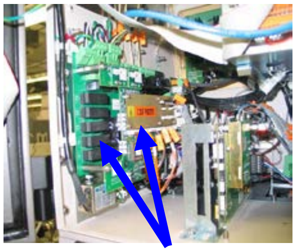
Figure 4-9: SYSCON Board

SYSCON2.1

Maintenance for the SYSCON2.1 is largely the same as for the SYSCON2.

Power Entry Control Module (PECM2) - New Version

Description



New two-part PECM

This section presents the procedures for removal or installation of the newest version of the Power Entry Control Module (PECM2). The PECM2 is also covered in detail in the PECM Installation Manual (Siemens part number 2000687-001).

When replacing the original version of the PECM it should be upgraded to the PECM2. This will require additional cabling. If upgrading from original PECM to PECM2, refer to the procedure in the Maxum II Extended Service Manual (Siemens part number A5E02220441001).

WARNING ⚠

Voltage dangerous to life exists. Before performing the removal and installation procedures, it is important that primary AC power to the Maxum II be turned off from the main circuit breaker. Observe all plant safety requirements before performing any repair or maintenance on the Maxum II.

WARNING ⚠

The cable harness connectors and the chassis plugs associated with the Heater circuits are marked with orange identifier tags. Before reconnecting any connector or plug to a Heater circuit, ensure that the orange identifier tag on the connector or plug reads identical to the orange identifier tag on its mating connector.

The PECM2 assembly is mounted to the left wall of the Electronic Enclosure. The PECM2 assembly consists of a base board with attached temperature controller board. The temperature control board mounts directly on the base board. This section covers replacement of both the base board and the temperature control board.

Power Entry Control Module (PECM2), Continued

PECM2 Removal and Installaton

The following procedure should be used for replacement of the PECM2 in the Maxum II. If upgrading from original PECM to PECM2, refer to the Maxum II Extended Service Manual (part number A5E02220441001).

Step	Procedure
1.	Turn off power to the Maxum II at the main circuit breaker.
2.	Open electronic enclosure door (using a 4mm (5/32") Allen wrench if necessary). When door is open **DO NOT** place tension on the Maintenance Panel interface ribbon cable.
3.	Remove power connections from PECM2. Secure and lable these connections for reattachment later.
4.	Remove cables connected to PECM2. Label each cable when it is removed.
5.	Unplug the atmospheric reference tube from the purge switch. (connection SW1, tubing connection on the bottom board of the PECM2, middle right side, back). Refer to Figure 4-15.
6.	Use a 5mm nut driver or socket to loosen the two hex nuts at the top of each side of the base plate of the PECM2. Do not remove the nuts completely.
7.	Slide the PECM2 up and then lift it off of the mounting bolts.
8.	On the replacement PECM2 perform the following: • Verify that the Purge Disable jumper JP2 is set correctly. • Ensure the TL/OT boards are moved to the replacement PECM2 (J15 & J16) to maintain the same T-rating of the GC. • Install the appropriate fuses for either 115VAC or 230VAC in Fuse locations F1 and F2 and install covers. Refer to the table on the following page for fuse assignments). Be sure to replace the fuse cover over the fuses once the fuses are installed. • Move jumper cables or termination plugs to the replacement PECM2.

Power Entry Control Module (PECM2), Continued

Step	Procedure
9.	Making sure there are no wires behind the mounting position of the PECM2, install the replacement PECM2 on the mounting bolts.
10.	Reattach the atmospheric reference tube from the purge switch. (SW1, tubing connection on the bottom board on the PECM2, middle right side, back).
11.	Starting at the back of the PECM2, plug in all cables. Make sure that plug in locations and labels match. Refer to Figure 4-15.
12.	Reattach power connections and apply power to the analyzer.

Fuse	Function	Fuses for 115VAC	Fuses for 230VAC
F1	AC Power Circuit 1	16A (1901693-001)	10A (1901694-001)
F5	Heater Channel 6	6.3A (1901695-001)	6.3A (1901695-001)
F2	AC Power Circuit 2	16A (1901693-001)	10A (1901694-001)
F4	LWH 1-5 (low wattage heaters)	10A (1901694-001)	10A (1901694-001)
F3	Power Supply (24V out)	3.15A (1302004-033)	3.15A (1302004-033)

Table 4-2: PECM2 Fuse Assignments

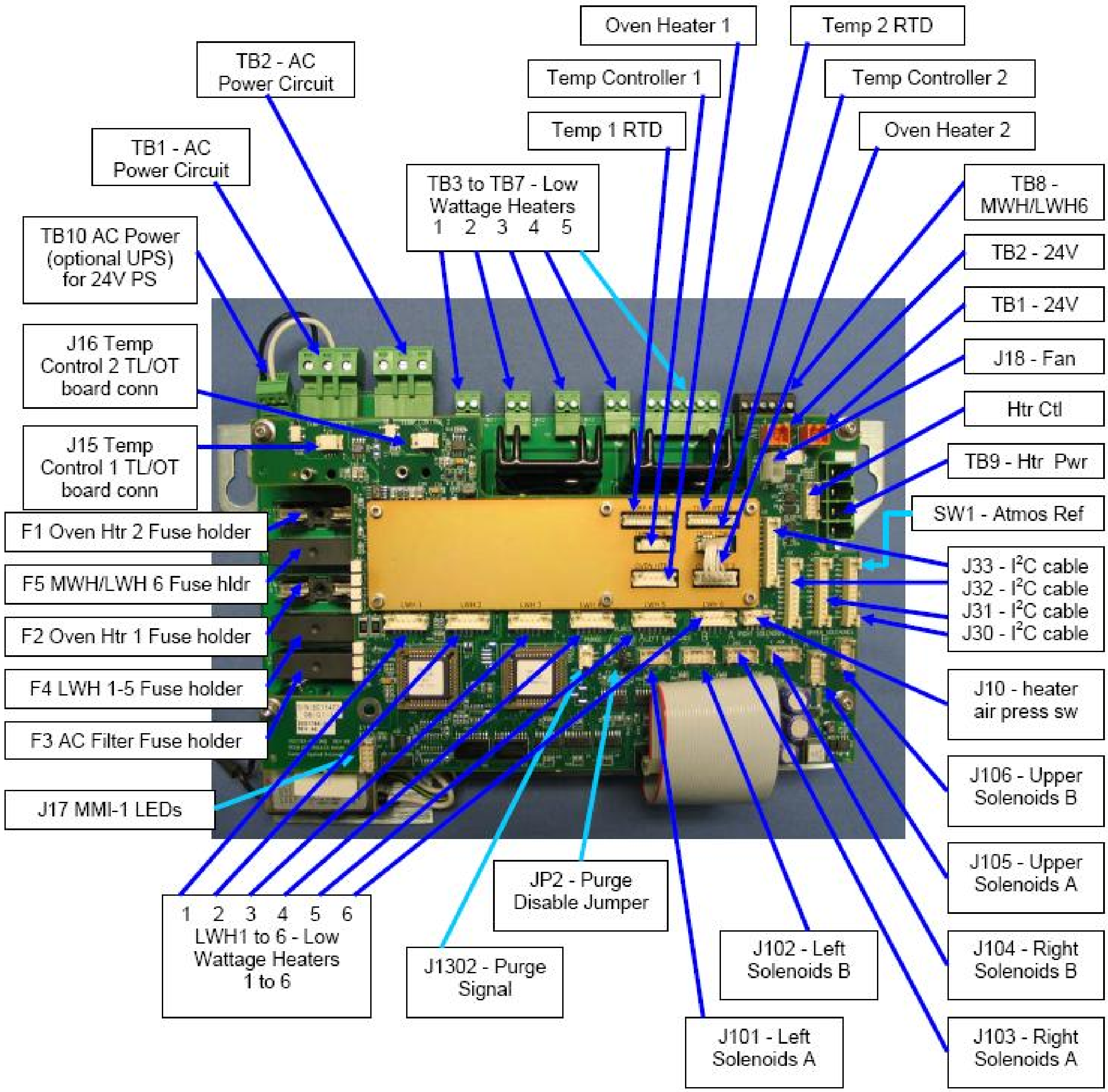


Figure 4-15: PECM2 Assembly Layout

Power Supply

Description

This section presents the procedures for removal or installation of the Power Supply. The Power Supply is mounted to the top of the electronic enclosure. Location is to the left side of the SYSCON Assembly.

WARNING

⚠

Voltage dangerous to life exists. Before performing the removal and installation procedures, it is important that primary AC power to the Maxum II be turned off from the main circuit breaker. Observe all plant safety requirements before performing any repair or maintenance on the Maxum II.

Procedure

The following procedures should be followed for removal and installation of power supply. Refer to Figure 4-16.

CAUTION

⚠

Before loosening, but not removing, the four mounting screws that secure power supply to inside top of enclosure, firmly grasp the power supply so it does not fall onto components mounted in bottom of enclosure.

Power Supply Removal and Installaton

Step	Procedure
1.	Open electronic enclosure door (using a 4mm (5/32”) Allen wrench if necessary). When door is open **DO NOT** place tension on the Maintenance Panel interface ribbon cable.
2.	Remove the power entry control module power cable connector from front of power supply.

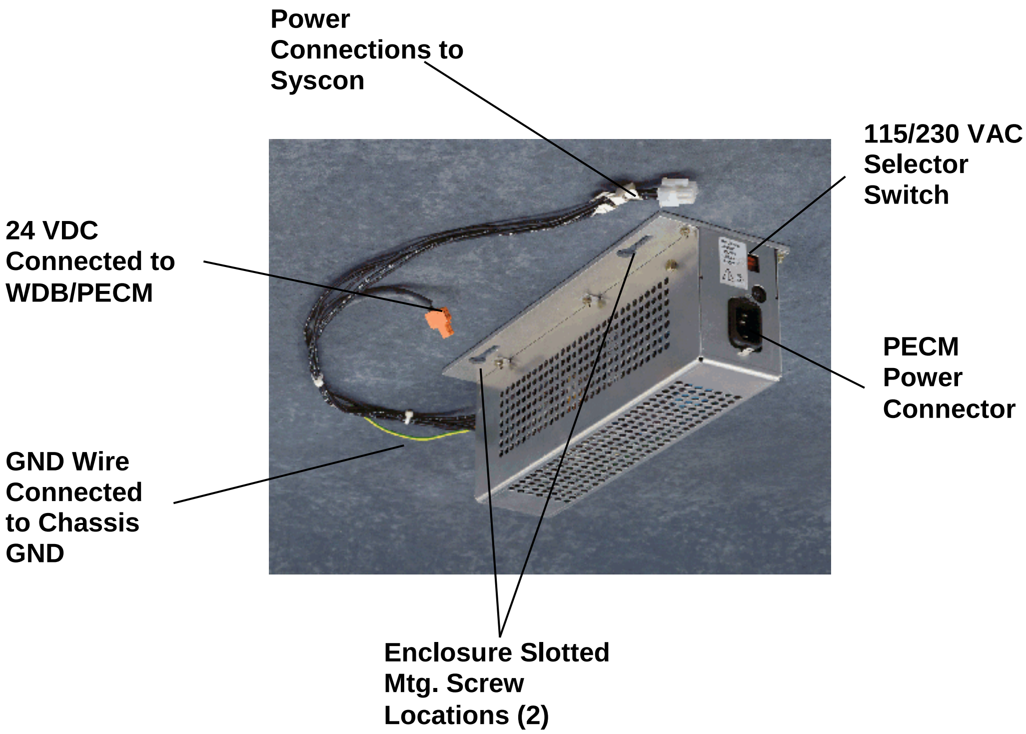


Figure 4-16: Power Supply Mounting Configuration

Step	Procedure
3.	Disconnect and label any cables that run power supply to other devices.
4.	Unplug the power supply chassis ground wire from its spade plug on the analyzer chassis. This plug is located on the back wall of the analyzer behind the power supply.
5.	Loosen but **do not** remove the two #5 mounting nuts from left side of power supply.
6.	Firmly grasp the power supply, slide it forward until it touches the front frame of electronic enclosure upper frame. This should clear mounting bolts and release the right side of supply from SYSCON mounting bracket.

Power Supply, Continued

Step	Procedure
7.	Rotate the lower left side downward to clear mounting hardware then remove the power supply by lifting it out to the left.
8.	To reinstall the power supply, perform steps 1 to 7 in reverse order.
9.	After installation of power supply, reconnect all power cables to the WDB and SYSCON. Connect green ground wire to electronic enclosure chassis.

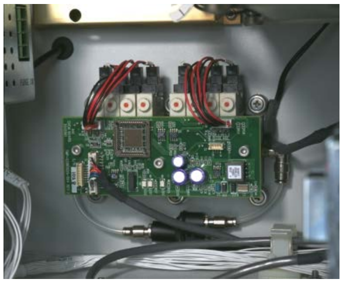
CAUTION ⚠

Before applying primary AC power to the power supply after installation, be certain the power supply red 115/230 VAC selector switch is set to the input primary AC power source voltage.

10.	Before closing electronic enclosure door and reapplying AC power, be certain all interface cables are correctly connected from the power supply to other modules within the analyzer.

Solenoid Valve Control Module (SVCM)

Description



This section presents the procedures for removal or installation of the Solenoid Valve Control Module (SVCM). The SVCM is mounted on the back wall of the electronic enclosure; depending upon your installation you can have up to three modules. There are two configurations of SVCM. The old version, which is still supported as a spare part, is equipped with a valve driver circuit board. For the newer version of the SVCM, this valve drive circuitry has been moved to the PECM module. Also, the old version uses a Parker brand solenoid, and the new version uses an SMC brand solenoid.

IMPORTANT

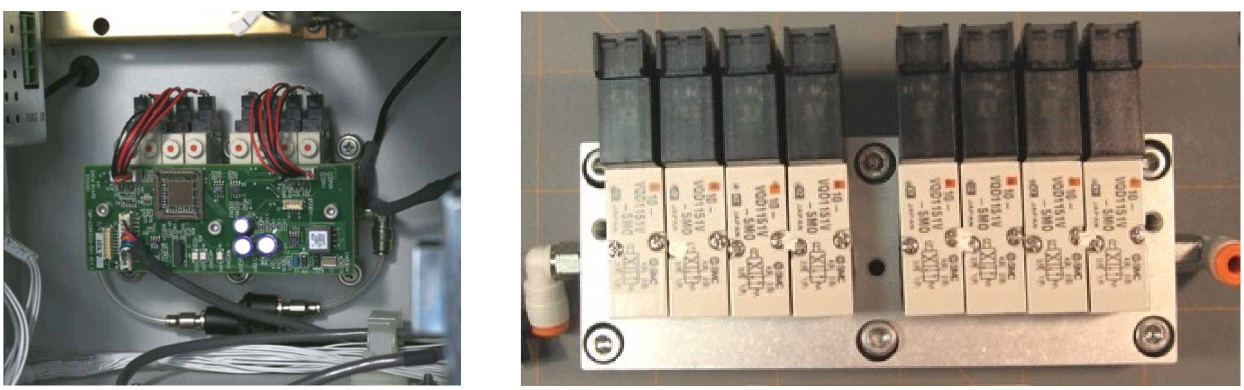
If the old configuration is in use, it is necessary that the valve driver circuit board be removed in order to remove the bank of eight latching solenoids. This allows access to the module mounting hardware. The screws securing the module to the rear of the electronic enclosure wall are captive and cannot be fully removed. The screws are removed with the SVCM assembly.

WARNING ⚠

Voltage dangerous to life exists. Before performing the removal and installation procedures, it is important that primary AC power to the Maxum II be turned off from the main circuit breaker. Observe all plant safety requirements before performing any repair or maintenance on the Maxum II.

CAUTION ⚠

There are 15 Viton O-rings installed in each latching solenoid bank. After removal of a solenoid bank, the assembly should be inspected to be certain all O-rings have remained installed. These O-rings ***must be*** in place when the bank assembly is reinstalled. For their location, refer to Figure 4-20.



Old SVCM **New SVCM**

Figure 4-17: Old and New SVCM Assemblies

Procedures

Procedures are presented for removal of the circuit board and then the latching solenoids. Refer to Figures 4-17 through 4-20.

IMPORTANT

Depending on the configuration of the Maxum II, it may be necessary to remove an SNE assembly in order to properly access the SVCM assembly for removal. Refer to the SNE maintenance section of this manual for instructions on removing an SNE assembly.

Removal SVCM Electronics Controller (Old SVCM Only)

Step	Procedure
1.	Open electronic enclosure door (using a 4mm (5/32") Allen wrench if necessary). When door is open **DO NOT** place tension on the Maintenance Panel interface ribbon cable.
2.	Disconnect both solenoid cables J10 and J11 connected to circuit board. Also disconnect J1, J2 and J3. Refer to Figure 4-18.
3.	Remove three 5mm Allen mounting screws securing SVCM to relay bank mounting standoffs. These are not captive screws and **MUST BE** completely removed.
4.	Remove circuit board from mounting standoffs. To remove, grasp board by its sides to prevent static discharge which could damage components.
5.	To reinstall a new circuit board, perform steps 1 to 4 in reverse order. To prevent damage to SVCM, **DO NOT** over tighten mounting screws (screws should be tightened firmly but not torqued down).

CAUTION

⚠

In the following procedure, when removing the older configuration SVCM assembly, **DO NOT** remove connectors from individual relays. The connectors should remain connected to each relay.

SVCM Solenoid Assembly Removal and Installation

Step	Procedure
1.	Remove the tubing from each right angled elbow fitting. These fittings are located on the left and right side of SSR mounting assembly. Refer to Figures 4-19 and 4-20. (Old SVCM) To remove hose from fitting, pushup on fitting collar then pull tubing from fitting. After tubing is removed, collar will return to its original position. (New SVCM) To remove hose from fitting, pull tubing from fitting while pushing in on orange fitting collar. Note: For ease in removing tubing from collar, the right angled fittings can be rotated for easier access to collar.
2.	**(Old SVCM) DO NOT** remove cables from installed relays. **(New SVCM)** Verify the labeling on the individual cables from the relays. Then, remove the cables from the relays. Do not disconnect the cables at the PECM end.
3.	Remove the six 5mm allen head assembly mounting screws. These are captive screws that stay with the assembly. Do NOT remove the six nuts next to the SVCM assembly. These connect the SVCM tubing manifold to the back of the Electronics Assembly
4.	Slowly pull the solenoid assembly from its mounting assembly. The mounting standoffs will be removed with the assembly.

Solenoid Valve Control Module (SVCM), Continued

Step	Procedure
5.	After the assembly has been removed, examine its electronic enclosure mounting surface to be certain all 15 O-rings are still installed. Check O-rings to be certain they are not damaged or cut. Any defective O-ring **MUST BE** replaced. **“O” RING PART REPLACEMENT:** • QTY 12: #039006-1/8” • QTY 3: #039008-3/16”
6.	Install right angled fittings on both the left and right sides of the replacement assembly.

CAUTION

Before installation of a SVCM, check enclosure mounting surface to be certain all 15 O-rings are installed. If any O-ring is lost or damaged, replace it with a new one. *Never install* assembly with a defective O-ring. Any contaminants not removed from mating surfaces will allow pressure losses resulting in inaccurate analytical analysis results**.**

7.	To reinstall a new SVCM relay assembly, perform steps 1 to 7 in reverse order.

IMPORTANT

To reinstall tubing on right angled fittings, simply push tubing into collar as far as it will go. Collar will automatically move with tubing. When installed, pull on tubing to be certain it is securely fastened in fitting.

8.	**(Old SVCM Only)** After reinstalling assembly, reinstall the circuit board by performing the removal procedures 1 to 5 in reverse order.
9.	Before reapplying AC power, be certain the SVCM assembly is securely fastened to its electronic enclosure mounting surface, hoses are tightly fastened to right angled fittings and assembly wiring harness connectors are connected to correct SVCM connectors.

Solenoid Valve Control Module (SVCM), Continued

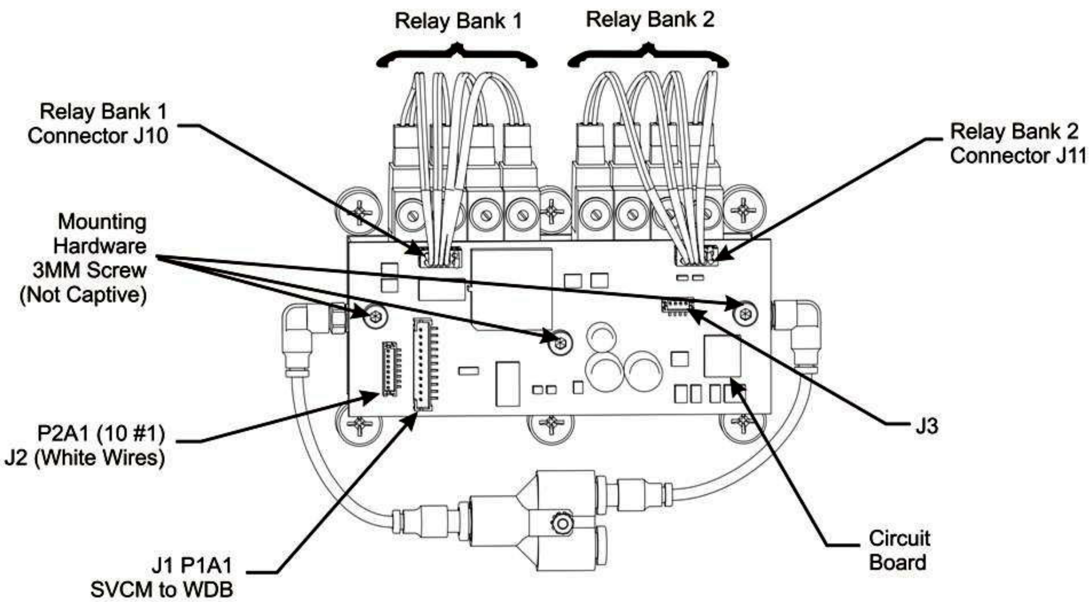


Figure 4-18: Old SVCM Installation and Removal Diagram

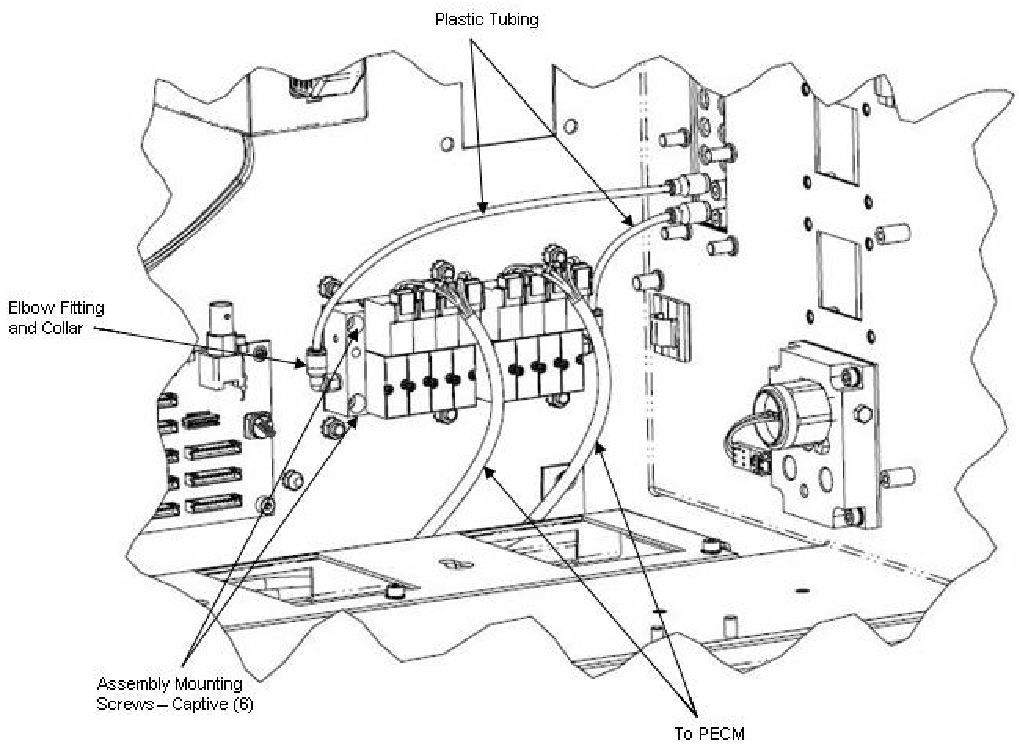


Figure 4-19: New SVCM Installed

Solenoid Valve Control Module (SVCM), Continued

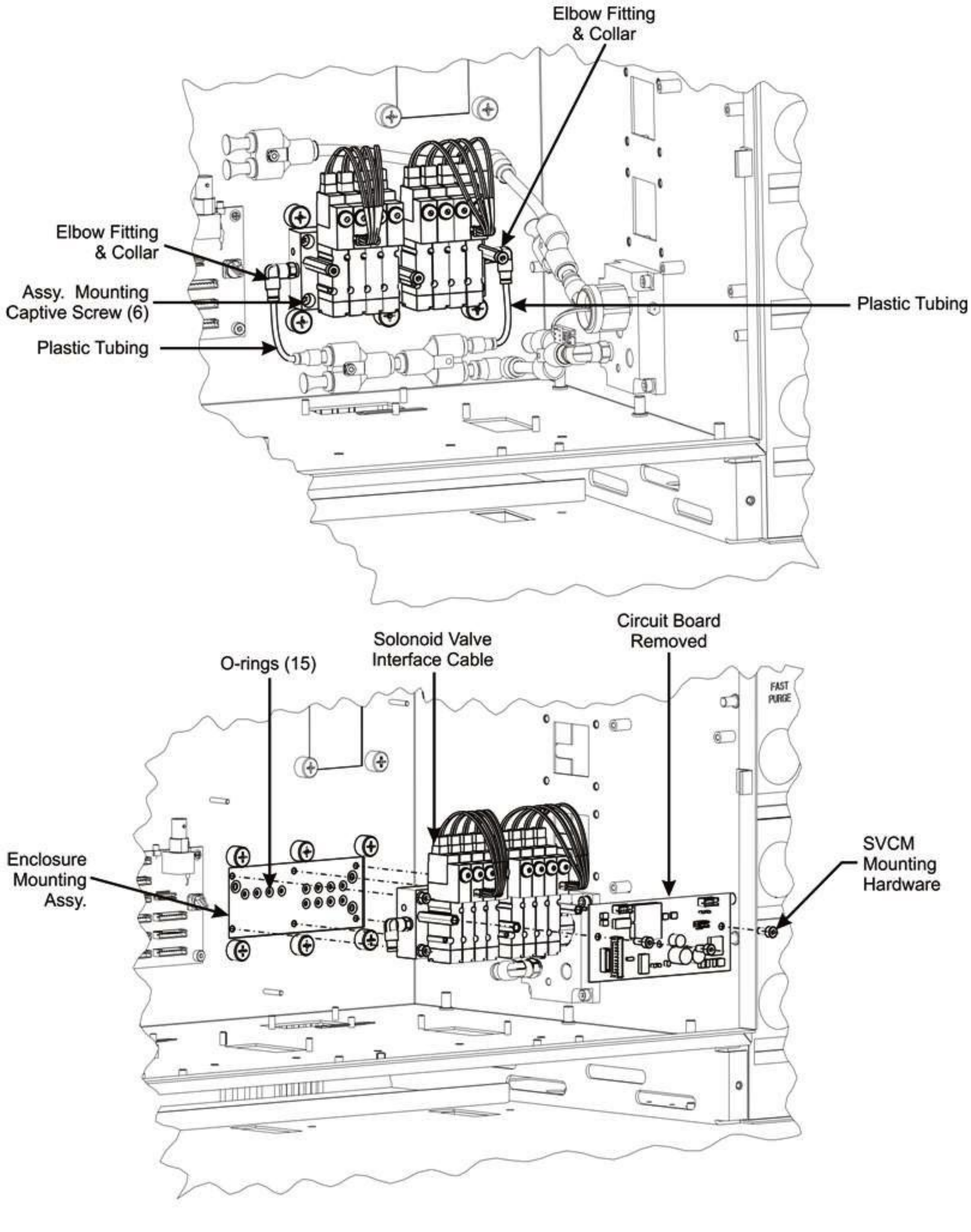
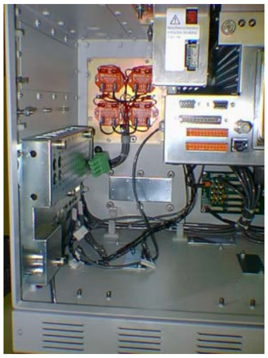


Figure 4-20: Old SVCM Assembly Removal and Installation

Solid State Relay Module

Description



This section presents the procedures for removal or installation of the solid state relay module. The module is mounted behind a protective cover plate located on the left side of enclosure back wall.

WARNING

Voltage dangerous to life exists. Before performing the removal and installation procedures, it is important that primary AC power to the Maxum II be turned off from the main circuit breaker. Observe all plant safety requirements before performing any repair or maintenance on the Maxum II.

CAUTION

To ensure correct replacement of all removed wires, label each wire as to which relay connector it is connected. For example connector SSR-2 is connected to relay SSR2 terminal 2. Also note the relay connection points for the jumper wires.

Installation Note

Two different configurations of Solid State Relay Module are available, the SSR and the Medium Wattage SSR. Procedures for both configurations are given in this section. It is not possible to replace a single relay on the Medium Wattage SSR

Procedures

The following procedures should be followed for removal and or installation of solid-state relay module. Also included are procedures to replace a single relay on the SSR module or to replace the Medium Wattage SSR assembly. Refer to Figure 4-21.

Solid State Relay Module Removal and Installation (Not the Medium Wattage SSR)

Step	Procedure
1.	Open electronic enclosure door (using a 4mm (5/32") Allen wrench if necessary). When door is open **DO NOT** place tension on the Maintenance Panel interface ribbon cable.
2.	Disconnect PECM to SSR Power connector. This allows for easier removal of the module.

IMPORTANT

For ease in removing relay cover, extend right side of cover outward, lift up on PECM power cable, and then extract cover.

3.	Remove the two cover plate spring loaded retaining captive screws, and then remove cover. The cover plate is mounted on standoffs and retaining screws are removed when cover is removed.
4.	Remove the plastic shield (if installed) that covers the relays on the SSR module.
5.	Before removal of each cable harness connector from its relay termination, label the harness connector with its relay connection point. For example, connector SSR-2 is connected to relay SSR2 terminal 2.
6.	Loosen cable harness clamp and remove clamp from around harness.
7.	Remove all the cable harness connectors connected to the SSR module. **DO NOT** disconnect the other internal connectors on the SSR module.

Solid State Relay Module, Continued

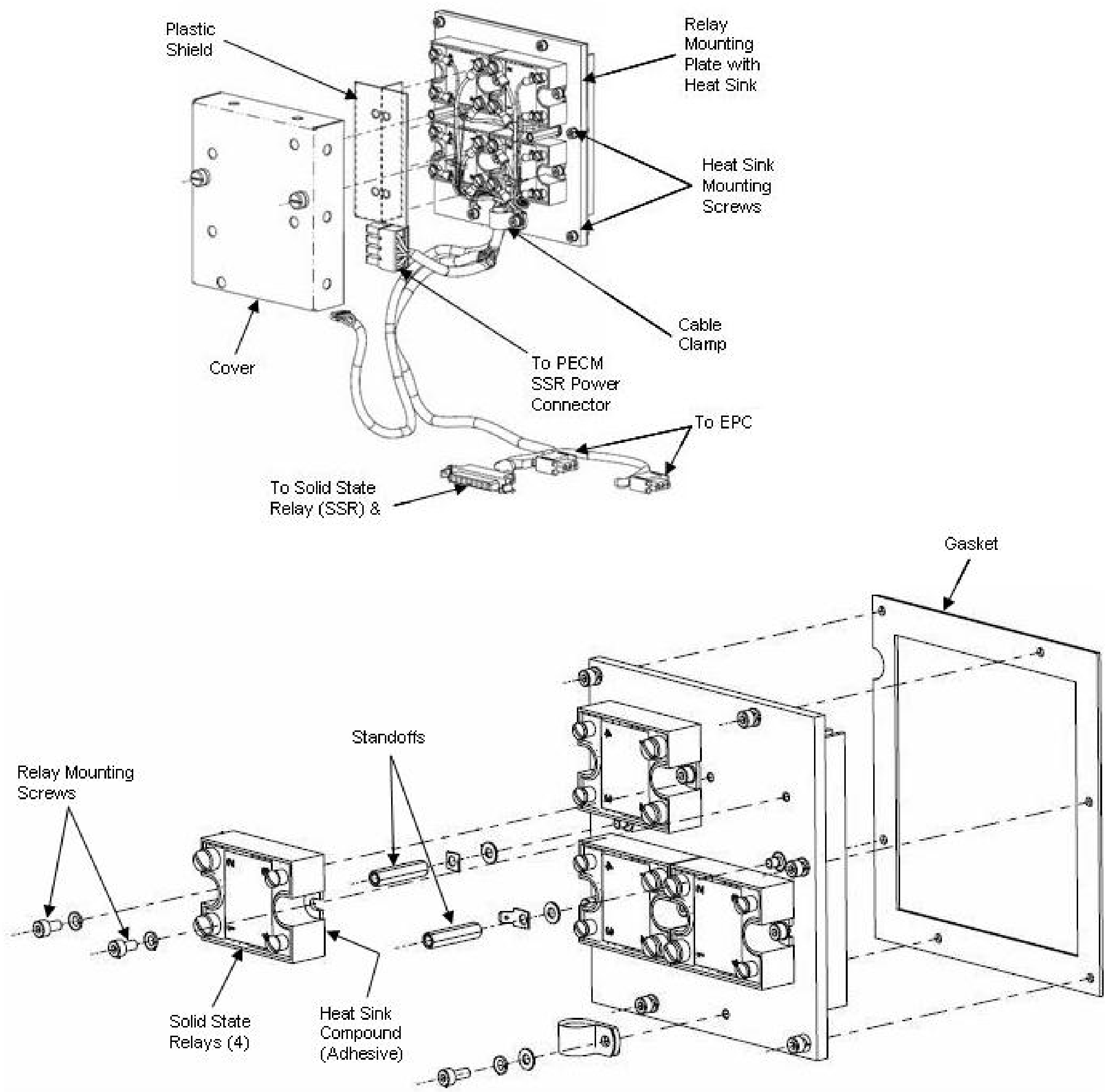


Figure 4-21: Solid State Relay Module

Solid State Relay Module, Continued

IMPORTANT

Although each cable is identified, it is recommended that you identify each cable as to its relay termination point.

Step	Procedure
8.	Remove the two ground connection lugs from each cover standoff. Depending on configuration standoffs may not need to be removed. If the lugs are a "spade" type then the standoffs will only need to be loosened. If the lugs have a closed hole, then the standoffs must be removed. To loosen or remove standoffs, use a 5mm nut driver.
9.	Using a 5mm Allen wrench, remove the six mounting screws securing relays to electronic enclosure back wall standoffs. Remove the solid-state relay module. Relays are mounted to heat sink assembly.

IMPORTANT

When the solid-state relay module is removed, the rear mounted heat sink is also removed as part of the relay mounting assembly.

10.	Remove solid-state relay module assembly.
11.	To reinstall the solid-state relay module, repeat steps 1 to 10 in reverse order.

IMPORTANT

When reinstalling relay cover, lift up on PECM power cable and insert left side of cover at an angle. Before securely tightening fastening screws, be certain wiring harness is installed within cover cutout opening. **DO NOT** pinch wiring harness.

12.	Before closing electronic enclosure door and reapplying AC power, be certain all cable harness connectors are connected to their correct relay terminations.

Solid State Relay Module, Continued

Removal and Installation of a Single Relay

Step	Procedure
1.	Open electronic enclosure door (using a 4mm (5/32”) Allen wrench if necessary). When door is open **DO NOT** place tension on the Maintenance Panel interface ribbon cable.
2.	Disconnect PECM to SSR Power connector. This allows for easier removal of the module.
3.	Remove the two cover plate spring loaded retaining captive screws, and then remove the cover. The cover plate is mounted on standoffs and retaining screws are removed when cover is removed.
4.	Remove the plastic plate (if installed) that covers the relays on the SSR module.
5.	Before removal of each cable harness connector from its relay termination, label the harness connector with its relay connection point. Remove each connector from the relay that is to be replaced as well as any other connectors for wires that would prevent the removal of the relay.
6.	Remove the screws that secure the relay to the module. Since the heat sink compound on the back of the relay acts as an adhesive, the relay will remain secured to the module.
7.	Break the relay free from the adhesive by pulling firmly, and then remove the relay from the enclosure.
8.	Install the new relay by applying the heat sink compound and repeating steps 1 to 7 in reverse order.
9.	Before closing electronic enclosure door and reapplying AC power, be certain all cable harness connectors are connected to their correct relay terminations.

Solid State Relay Module, Continued

Note

Refer to Figure 4-22 on the next page when executing the following procedure.

.

Medium Wattage Solid State Relay Module Removal and Installation

Step	Procedure
1.	Open electronic enclosure door (using a 4mm (5/32") Allen wrench if necessary). When door is open **DO NOT** place tension on the Maintenance Panel interface ribbon cable.
2.	Unplug the power cable and the control cable from the Medium Wattage Solid State Relay Module. Unplug the cables only at the SSR end. Leave them plugged in at their opposite ends.
3.	Remove the Medium Wattage SSR by unscrewing the Allen head screws that secure it to the enclosure. Note: There is a gasket located between the SSR and the enclosure back wall. Set this gasket aside for use in reinstalling the new SSR.
4.	Install the new Medium Wattage SSR by executing steps 1 to 3 in reverse order.

Solid State Relay Module, Continued

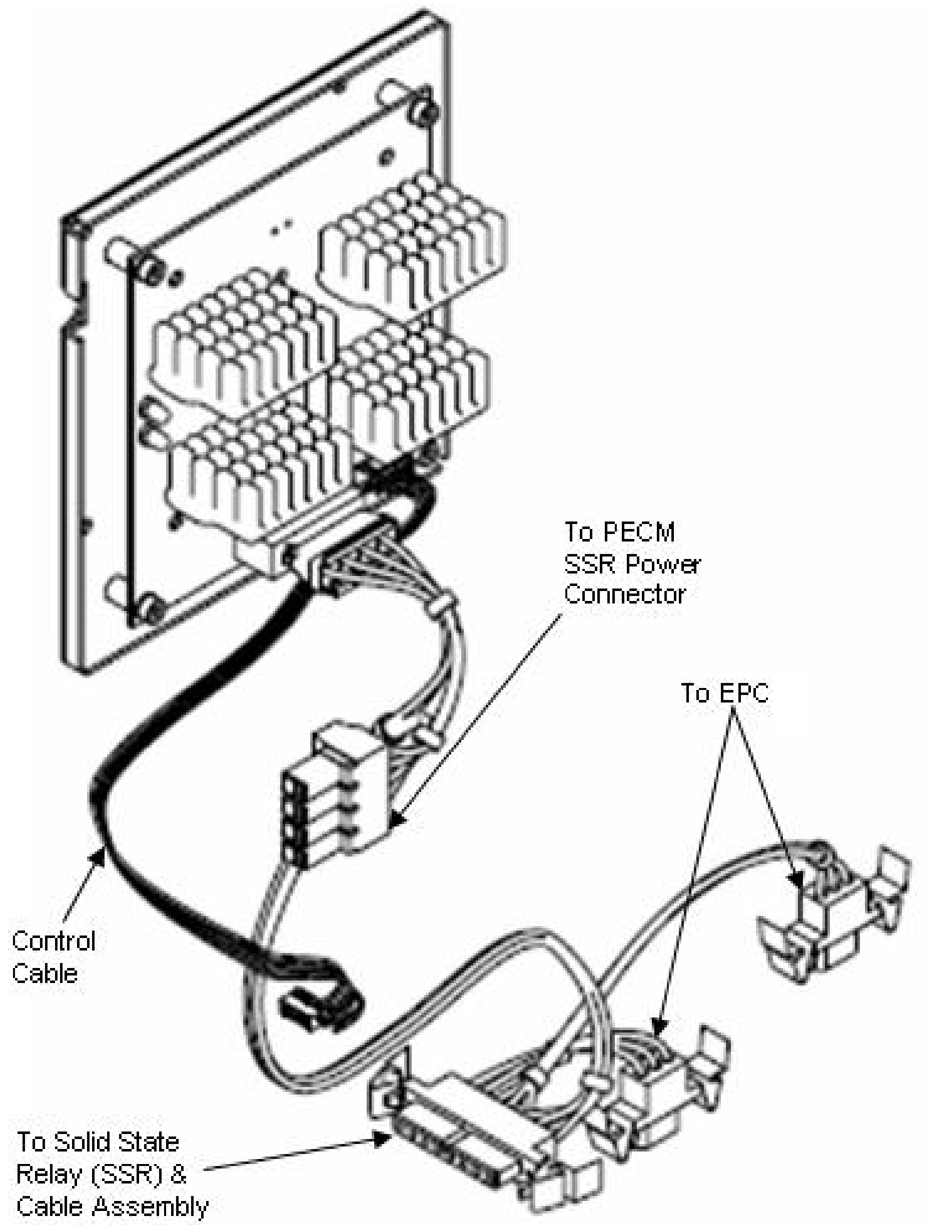
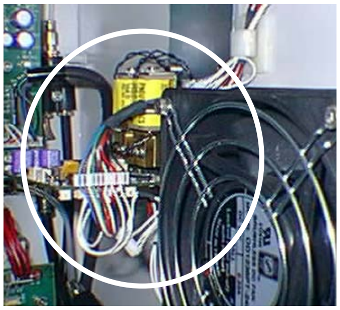


Figure 4-22: Medium Wattage Solid State Relay Module

Electronic Pressure Control Module

Description



This section presents the procedures for removal or installation of Electronic Pressure Control (EPC) Module. The Module is located on the upper right side wall of the electronic enclosure directly behind the Air Circulating Fan.

Two different versions of the EPC exist. These versions are functionally the same. The primary difference is in the way that the board identification is set. This difference is described in detail at the end of this procedure.

WARNING

⚠

Voltage dangerous to life exists. Before performing the removal and installation procedures, it is important that primary AC power to the Maxum II be turned off from the main circuit breaker. **Observe all plant safety requirements before performing any repair or maintenance on the Maxum II.**

CAUTION

⚠

The EPC Module and the attached manifold are one assembly. This assembly is critical to safety certification and as such must not be disassembled. Replacement of the EPC includes replacement of the manifold.

Procedures

The following procedures should be followed for removal and installation of the EPC. Refer to Figure 4-23.

Step	Procedure
1.	Open electronic enclosure door (using a 4mm (5/32") Allen wrench if necessary). When door is open **DO NOT** place tension on the Maintenance Panel interface ribbon cable.
2.	Disconnect any external interface connectors to EPC. It is recommended that all cables be identified with their EPC connector location.
3.	Remove the external gas connections from the EPC, labeling each if necessary.

Electronic Pressure Control Module, Continued

CAUTION ⚠

The EPC is made up of a manifold that is mounted to the electronic enclosure wall on standoffs and the module itself. Due to safety and certification issues, it is necessary to replace both the EPC and manifold as one assembly.

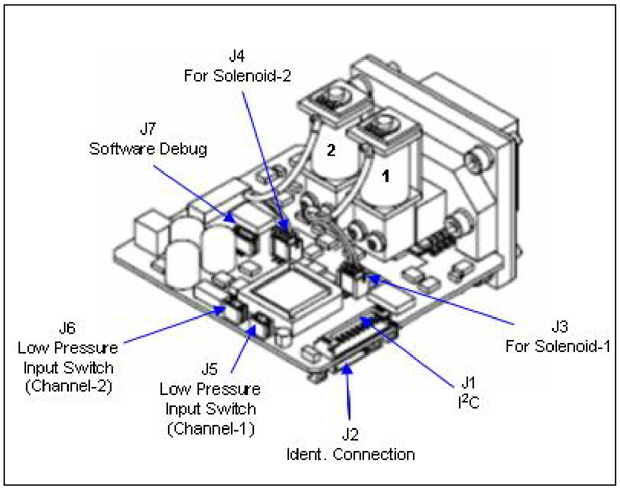
CAUTION ⚠

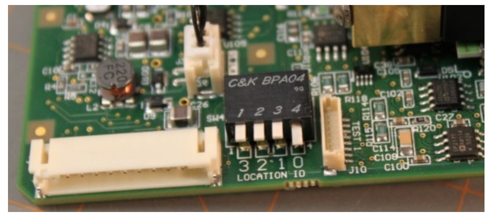
The ferrules connected on the gas supply side of the EPC manifold are composed of vespel-graphite. To prevent damage, these ferrules must NOT be over-tightened. Proper tightness is typically ½ turn past finger-tight.

Step	Procedure
4.	Remove the four 4mm Allen screws that secure the manifold to the Electronics Enclosure and then remove the assembly. These are captive screws and will be completely removed with module.
5.	If the new EPC is not equipped with a module ID jumper, move the jumper that is connected to location J2 from the old module to the new module. or, If the EPC is equipped with ID switches, set the switches on the replacement EPC to match the ID of the EPC that was removed (see “Setting Location ID” on the next page).
6.	To reinstall the new EPC, perform steps 1 to 4 in reverse order. Use caution when reconnecting gas lines. Do not over-tighten.
7.	Before applying AC power, be certain the gasket between the manifold and the Electronics Enclosure is properly seated and interface cable connectors are correctly connected.

IMPORTANT

After replacing the EPC assembly it is necessary to inspect the system for leaks.



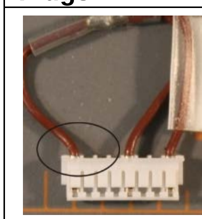
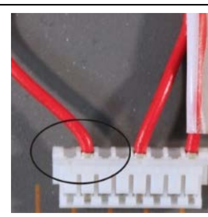
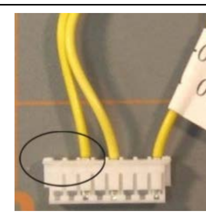
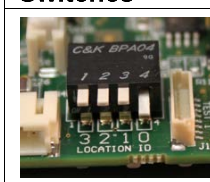
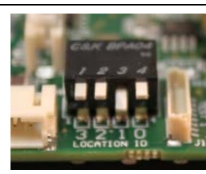
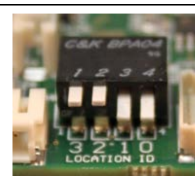
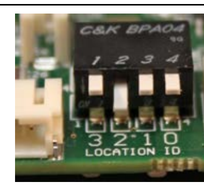


Original EPC Connectors — DIP Switches on New EPC

Figure 4-23: EPC Connector Locations

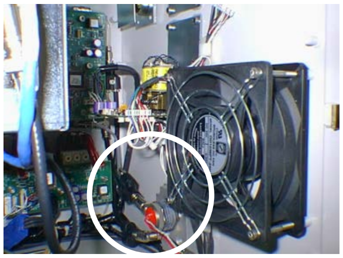
Setting Location ID

As shown above, the newest version of the EPC has DIP switches in place of the J2 ID Connector used in the previous version. These are used to set the location ID, which is used in software as part of the hardware ID string. The location ID is set using a binary counting of the switches from right to left (as numbered on the board and not on the actual switches). Note that this also matches binary wiring of the first three pins of the J2 plugs used in the older version EPC.

Location ID #1	Location ID #2	Location ID #3	Location ID #4
Plugs			
			
Switches			
			
1st switch / connector pin set (binary 1)	Second switch / connector pin set (binary 2)	1st & 2nd switch / connector pin set (binary 3)	3rd switch / connector pin set (binary 4)

Purge Control Module (PCM)

Description



This section presents the procedures for removal or installation of the Purge Control Module (PCM). The PCM is located on lower right side wall of the electronic enclosure.

WARNING

Voltage dangerous to life exists. Before performing the removal and installation procedures, it is important that primary AC power to the Maxum II be turned off from the main circuit breaker. Observe all plant safety requirements before performing any repair or maintenance on the Maxum II.

Procedures

The following procedures should be followed for removal and installation of PCM pressure switch. Refer to Figures 4-24 and 4-25.

IMPORTANT

The pressure switch can be removed and replaced without having to remove the PCM module.

PCM Pressure Switch

Step	Procedure
1.	Open electronic enclosure door (using a 4mm (5/32") Allen wrench if necessary). When door is open **DO NOT** place tension on the Maintenance Panel interface ribbon cable.
2.	Note: In order to replace the solenoid pressure switch, it should NOT be necessary to remove the PCM assembly from the enclosure. Unplug the connector to the faulty solenoid pressure switch. Grasp connector from bottom section and pull straight out from mating section.

IMPORTANT

Before removal of pressure switch connecting wires, note pressure switch pin location that wires are connected to. It is recommended that each wire be labeled with its pin connector. Wires **MUST NOT** be interchanged.

Step	Procedure
3.	Using the appropriate size wrench, unscrew the faulty pressure switch from the PCM pressure switch control mounting assembly.

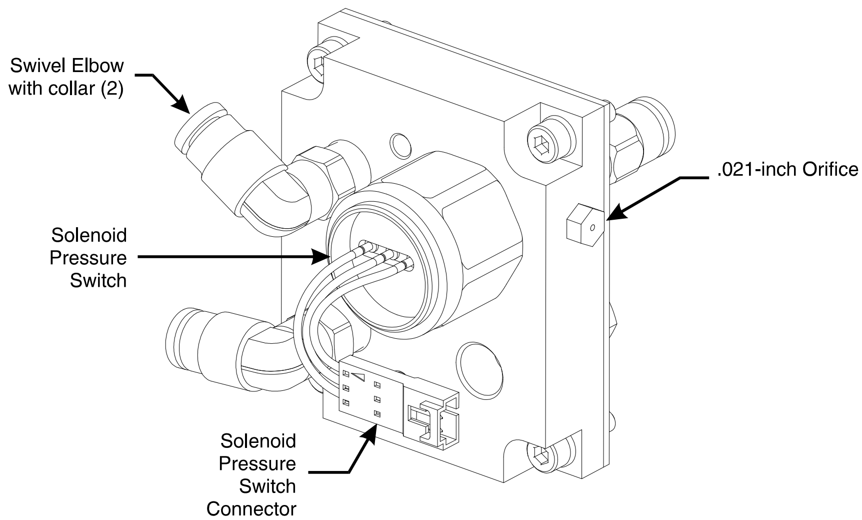


Figure 4-24: Purge Control Pressure Switch and Orifice Locations

4.	To reinstall PCM pressure switch, repeat steps 1 to 3 in reverse order. **CAUTION** ⚠ DO NOT over tighten pressure switch during installation**. Proper tightness should be approximately 1/4 turn past finger tight.**
5.	Before applying AC power, be certain the PCM pressure switch is securely installed.

.021-inch Orifice

The Orifice is located on the upper right side of the the PCM pressure switch control mounting assembly. The following procedures should be followed for removal and installation of PCM pressure switch .021-inch Orifice. The Orifice should be replaced if it becomes blocked-off or fails to perform its system function. Refer to Figure 4-24.

Step	Procedure
1.	Note: In order to replace the Orifice, it should NOT be necessary to remove the PCM assembly from the enclosure. Unscrew the Orifice assembly then remove from the PCM assembly.
2.	Screw the new orifice assembly into the PCM assembly.
3.	Before reapplying AC power, be certain the Orifice is securely installed. DO NOT over tighten Orifice during installation**. Proper tightness should be approximately 1/4 turn past finger tight.**

PCM Assembly Removal

The following procedures should be followed for removal and installation of PCM Assembly. Refer to Figure 4-25.

Step	Procedure
1.	Disconnect tubing connected to assembly front and rear mounted right angled elbow fittings. To remove tubing from fitting, push up on fitting collar then pull tubing from fitting. After tubing is removed, collar will return to its original position.
2.	Remove wires connecting to the solenoid pressure switch.

IMPORTANT

Note pressure switch pin locations where wires are connected. It is recommended that each wire be labeled with its pin connector. Wires **MUST NOT** be interchanged.

Purge Control Module (PCM), Continued

Step	Procedure
3.	Remove the four PCM assembly 5mm Allen mounting screws.
4.	Remove the PCM assembly from the electronic enclosure. When assembly is removed, the installation gasket should also be removed.
5.	To reinstall PCM assembly, repeat steps 1 to 4 in reverse order. **DO NOT** over tighten pressure switch during installation. **Proper tightness should be approximately 1/4 turn past finger tight.**

IMPORTANT

To reinstall tubing on right angled fittings, simply push tubing into collar as far as it will go. Collar will automatically move with tubing. When installed, pull on tubing to be certain it is securely fastened in fitting.

6.	Before applying AC power, be certain PCM assembly is correctly installed, tubing is tightly installed in right angled fittings and interface wiring is correctly connected to PCM switch pins.

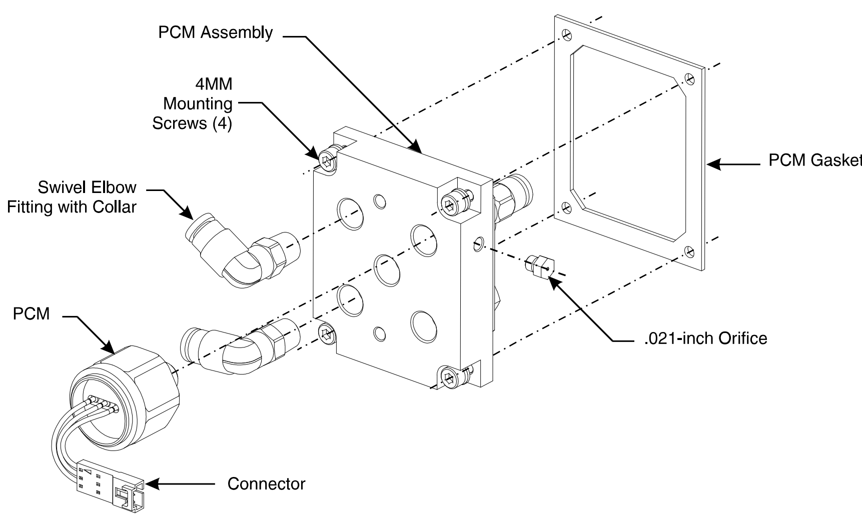
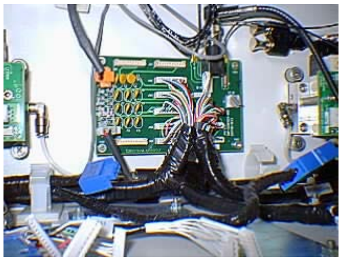


Figure 4-25: PCM Assembly Removal

Wiring Distribution Board

Description



This section presents the procedures for removal or installation of the Wiring Distribution Board. The board is located on lower rear wall of the electronic enclosure.

WARNING

⚠

Voltage dangerous to life exists. Before performing the removal and installation procedures, it is important that primary AC power to the Maxum II be turned off from the main circuit breaker. Observe all plant safety requirements before performing any repair or maintenance on the Maxum II.

CAUTION

⚠

Exercise caution when removing the Wiring Distribution Board. The board is secured in place by two 5mm captive screws located in the upper left and lower right corners with the other two corners secured by push-on fasteners.

Procedures

The following procedures should be followed for removal or installation of Wiring Distribution Board. Refer to Figure 4-26.

Step	Procedure
1.	Open electronic enclosure door (using a 4mm (5/32") Allen wrench if necessary). When door is open **DO NOT** place tension on the Maintenance Panel interface ribbon cable.
2.	Disconnect all interface cables from connectors J100 to J110. Label each connector with its terminating location for reinstallation.
3.	Disconnect air circulating fan connector J5. Label function of connector for reinstallation.
4.	Disconnect power supply voltage connector J1. Label function of connector for reinstallation.
5.	Note: This step is only applicable if connected to a network. Unplug connection to 10Base2 connector. Unplug connectors from J3 and J4. Label each connector with its termination point.

Step	Procedure
6.	Remove the upper left and lower right board mounting screws.
7.	To remove the board, place two fingers from each hand on back of lower left and upper right connectors and pull forward. Because the fasteners are a push-on type, the board will pop-off with little exertion.

CAUTION ⚠

Do not extract Wiring Distribution Board from push-on fasteners by grasping board by its sides. This will cause breakage of board or damage components**.**

8.	To reinstall a new Wiring Distribution Board, perform steps 1 to 7 in reverse order. Note: The switch setting S1 is not used in Maxum II and should be left at the default setting of 1.
9.	Before reapplying AC power, be certain all interface cables and network cables are connected to their correct Wiring Distribution Board terminations.

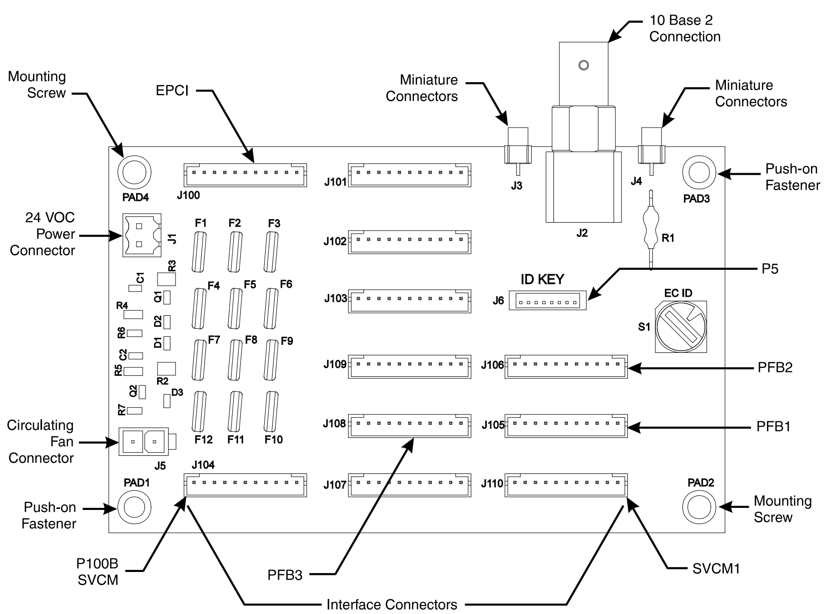
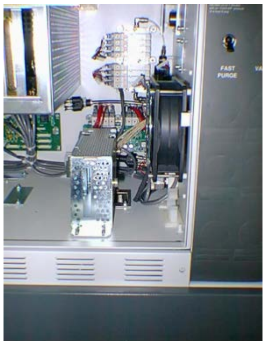


Figure 4-26: WDB Interface Connection Locations

Air Circulating Fan

Description

This section presents the procedures for removal or installation of the Air Circulating Fan located on the lower right front side wall of the electronic enclosure.



WARNING

Voltage dangerous to life exists. Before performing the removal and installation procedures, it is important that primary AC power to the Maxum II be turned off from the main circuit breaker. Observe all plant safety requirements before performing any repair or maintenance on the Maxum II.

Procedures

The following procedures should be followed for removal and installation of ACF. Refer to Figure 4-27.

Step	Procedure
1.	Open electronic enclosure door (using a 4mm (5/32”) Allen wrench if necessary). When door is open **DO NOT** place tension on the Maintenance Panel interface ribbon cable.
2.	Disconnect interface cable from Wiring Distribution Board (WDB) connector J5.
3.	Remove Air Circulating Fan interface cable from wiring harness bundle.
4.	Remove the four 5mm long Allen screws from each corner of Air Circulating Fan.
5.	Remove Air Circulating Fan.
6.	To reinstall a new Air Circulating Fan, perform steps 1 to 5 in reverse order.
7.	Before reapplying AC power, be certain fan power cable is securely connected to WDB connector J5 and power cable is reinstalled in wiring harness bundle.

Air Circulating Fan, Continued

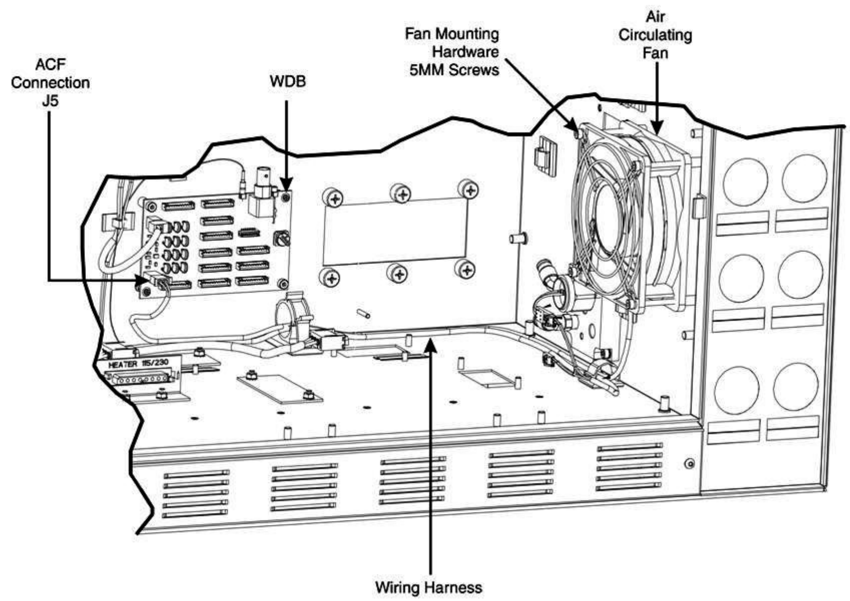


Figure 4-27: Electronic Enclosure Fan Location

Model 50 Valve

Description

This section provides maintenance instructions for the Model 50 Valve. The Model 50 is a pneumatically operated diaphragm valve specifically designed for process gas chromatography. It uses pressure-on-diaphragm activation with no other moving parts. The valve can inject vapor samples and switches columns simultaneously. It is capable of switching gasses up to 75 psig (515 kPa).

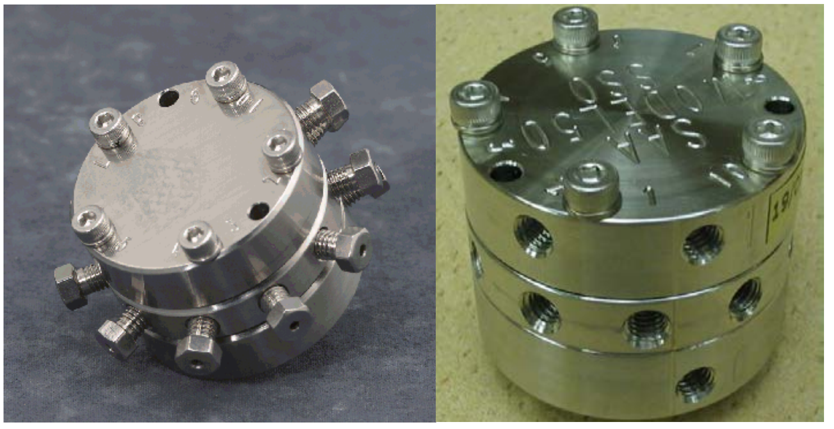


Figure 4-28: Model 50 Valve

Repair Kits & Fixtures

The following equipment is required to repair the Model 50 Valve:

Model 50 Repair Kit: Siemens PN 2020164-001 (includes 10 diaphragms, 10 screws with washers, and 12 Valco fittings).

Valve Assembly Fixture: Siemens PN 2020281-001

Torque screwdriver with Allen head bit: Siemens PN 1631005-003

Preventing Port to Port Leaks

Particulates introduced to the valve either from the sample or from the columns can prevent the diaphragms from sealing against the center plate of the valve. Also, to insure proper sealing of the diaphragms, the actuation pressure should be 25 psig higher than the carrier gas or sample gas pressure.

To help prevent leaks always turn the Sample and Carrier Gas off before the Actuation Gas is turned off. Without Actuation Gas the Model 50 Valve is in an undefined state and the flow path of the carrier or sample cannot be controlled. Leaks in the Actuation Gas lines could result in a lower Actuation Gas pressure which could result in port to port leaks. The symptoms can include small peaks, repeatability problems, contaminated columns and noise on the detector.

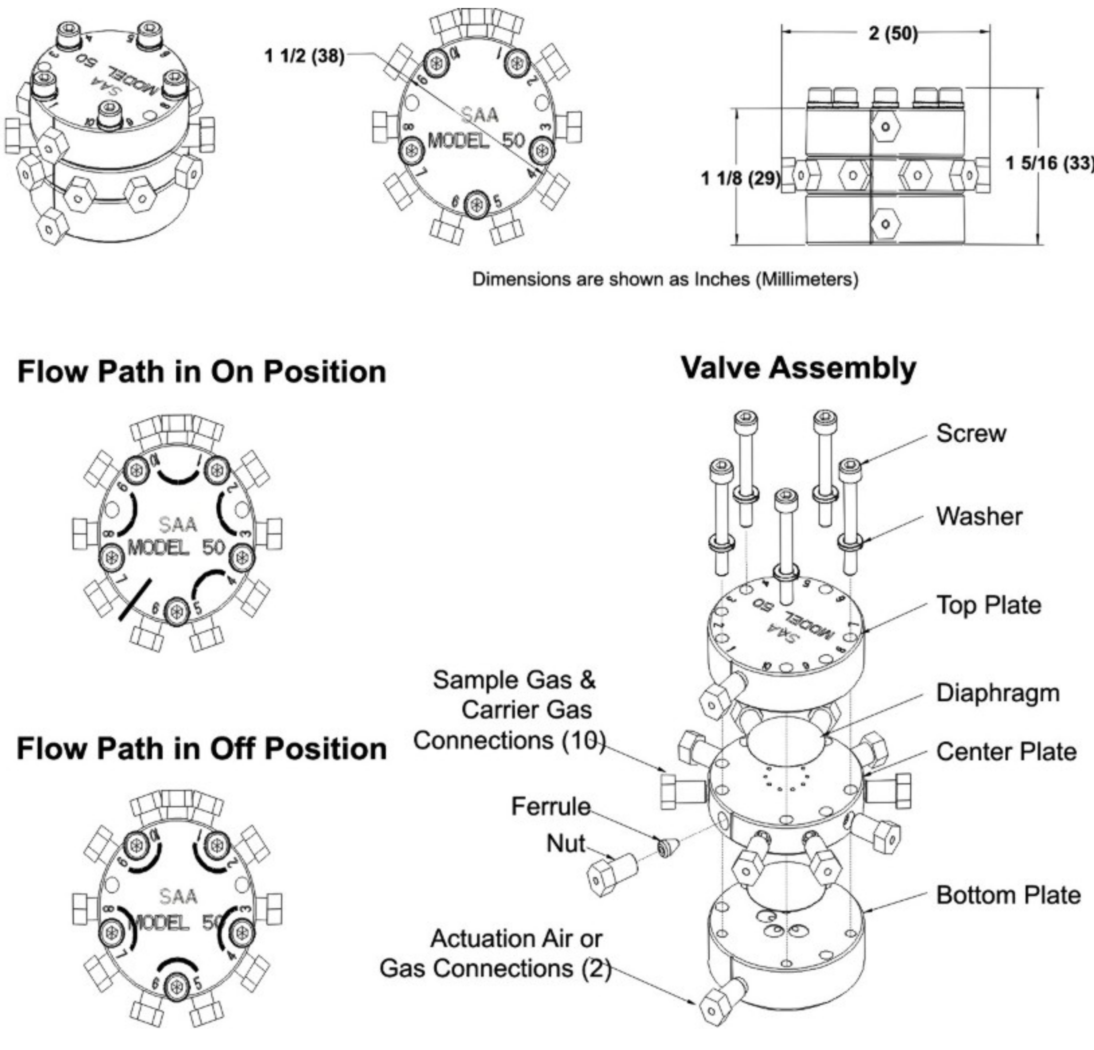


Figure 4-29: Exploded View of Model 50 Valve

Maintenance Personnel

If customer maintenance personnel are not technically trained to repair the Model 50 Valve on site, it is recommended that the valve be returned to Siemens for repair or direct replacement.

Direct Valve Replacement

If it is determined that the problem is directly related to the Model 50 Valve system performance, the customer must make a determination if the valve can be repaired on site or if it should be returned to Siemens for repair or replacement.

Repair of Valve

To repair the Model 50 Valve on site, the customer must have the necessary maintenance tools and replacement parts. Recommended valve spare parts can be obtained from Siemens.

Maintenance Facility

When cleaning the Model 50 Valve and associated components, it is imperative that the maintenance be performed in a clean and contaminant free facility. Components should be placed on a lint free cloth to prevent impurities from contaminating the valve and its components. Hands should be clean and free of contaminants.

If Model 50 Valve maintenance is to be performed on site, the area must be clean and free of foreign contaminants. Presence of any foreign contamination can cause additional valve problems after reinstallation.

All foreign contamination adhering to valve must be removed using cleaning solvent, such as hexane, acetone, or methanol and a dust/lint free cloth. After cleaning Model 50 Valve components, shake or blow with clean air the excess cleaning fluid from the individual components. Ensure that the components are air dry before reassembling.

CAUTION ⚠

Do not allow Model 50 Valve polished surfaces to rest on any surface other than a lint free cloth. Clean sample flow openings in top plate, center plate, bottom plate and Valco fitting nuts using a syringe filled with cleaning solvent such as hexane, acetone, or methanol.

WARNING ⚠

Voltage dangerous to life exists. Before performing the removal and installation procedures, it is important that primary AC power to the Maxum II be turned off from the main circuit breaker. Only maintenance personnel with proper authorization should open the electronic enclosure.

Maintenance Procedures

The valve is serviced by disassembling and then thoroughly cleaning the components to remove all particulates. Ultrasonic cleansing with a suitable solvent works very well. **During the cleaning and re-assembly process, care must be taken to avoid scratching or damaging the polished surfaces of the valve.** After cleaning, the valve is reassembled using new Teflon® coated stainless steel diaphragms. **DO NOT attempt to reuse old diaphragms.** Notice the alignment marks on the three sections of the valve near the actuation ports. The valve should be reassembled so that these marks line up. If the marks to not line up it is possible that the center plate is upside down. The screws should be tightened evenly to 6-8 inch pounds using the appropriate torque screwdriver with an allen head bit.

Valve Removal and Disassembly
(see Figure 4-29)

Step	Procedure
1.	From primary AC circuit breaker, turn analyzer AC primary power OFF.
2.	Shut off the air to the oven heater.
3.	Open Maxum II's oven door using a 4mm (5/32'") Allen wrench.
4.	To remove Model 50 Valve from the oven, first disconnect all tubing to the valve.

CAUTION ⚠

When disconnecting Valco fastening nuts from Model 50 Valve, exercise caution not to bend or crimp the stainless steel tubing.

NOTE

Before removing Model 50 Valve from oven make note of its orientation within the oven.

5.	Remove the valve from the oven by unscrewing the two M3 x 35 socket head cap screws securing the Model 50 Valve. These mounting screws are located between ports 2 and 3 and ports 8 and 9. Refer to Figure 4-29 for port locations.
6.	Place the valve on a clean dust and lint free cloth within a clean work environment.

CAUTION ⚠

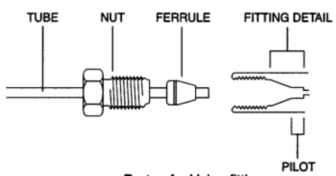
Do not place polished top plate, center plate or bottom plate against any abrasive surface. Place components on a lint free cloth free of foreign contaminants.

Step	Procedure
7.	Place the valve bottom plate on a lint free cloth. Using a 2.5 mm Allen wrench, remove the five component socket head fastening cap screws. Refer to Figure 4-29.
8.	Separate valve Top, Center and Bottom plates, placing them on a lint free cloth. Both diaphragms are visible.

Valco & Swagelok Fittings

The ports are machined for a 1/16" Valco internal nut. The Valco ferrule or the 2-piece Swagelok ferrule can be used. It is important to follow the manufacturer's procedures when cutting tubing and seating ferrules to ensure that the fitting does not leak.

Valco & Swagelok Assembly Instructions



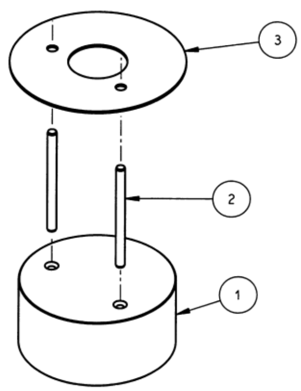
Parts of a Valco fitting

Use a wheel-cutting tool (Supelco 58692-U) to score the tubing, and then with a pair of straightening pliers (Supelco 58646) and a pair of needle nose pliers snap the tubing at the score line. Make certain that all tubing ends are cut square with the tube axis, and that both the ID and the OD are thoroughly deburred, use a deburring tool (Supelco 58804). Inspect the end of the tubing where the ferrule will seat for scratches along its length. Visible scratches along the tubing where the ferrule will seat are not acceptable, but those behind the front edge of the ferrule will not interfere with the integrity of the fitting.

Step	Procedure
1.	Slide the nut and ferrule onto the tubing.
2.	Insert this assembly in the fitting detail (valve body), screwing the nut 2 or 3 turns by hand.
3.	Push the tubing all the way forward into the details so that it seats firmly.
4.	Manually turn the nut until it is finger tight.

Step	Procedure
5.	Turn the nut ¼ turn (90 degrees) past the point where the ferrule first starts to grab the tubing.
6.	Remove the fitting and inspect it. The ferrule may be free to spin axially on the tubing but should have no lateral movement along the tubing. If it does, reinstall the fitting and tighten it another 1/8 turn past finger tight. Remove, re-inspect and repeat if necessary.

Replacing Diaphragms



Valve Assembly Fixture 2020281-001

Use the Valve Assembly Fixture, Siemens PN 2020281-001, properly align the Diaphragms when rebuilding the Model 50 Valve. The fixture consists of a base (1), 2 guide pins (2) and a diaphragm placement disc (3). This fixture will allow the user to place the diaphragm in the center of the valve. If the diaphragm is not in the center it may leak.

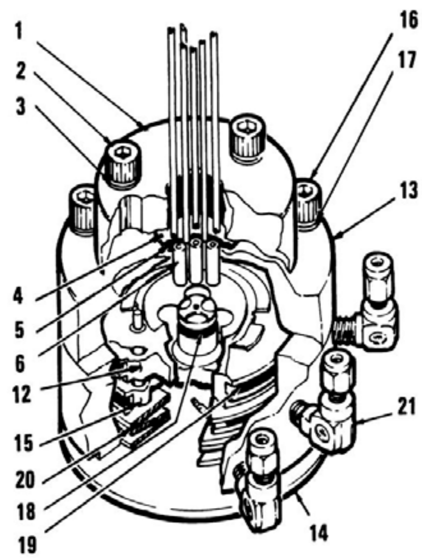
Step	Procedure
1.	Remove the old diaphragms from the plates. DO NOT attempt to reuse the old diaphragms.
2.	With the pins installed in the fixture base, place the bottom plate of the valve on the base. The pins should fit in the mounting holes on the bottom plate and hold it in place.
3.	Position the placement disc on the bottom plate and set the diaphragm in place .
4.	Carefully remove the placement disc without moving the diaphragm. Inspect the diaphragm for proper alignment.. If the diaphragm is not in the center of the plate, repeat the placement procedure using the placement disc.
5.	Place the middle plate on the valve taking care to use the correct holes. Check the alignment mark on the side of the plate. It should align with the mark on the bottom plate. If not, the middle plate is upside down and must be removed, turned over, and reinstalled correctly.

Step	Procedure
6.	Repeat steps 3 and 4 with the middle plate.
7.	Place the top plate on the valve, verifying alignment using the alignment marks.
8.	Install the 5 screws and washers finger tight.
9.	Tighten the screws down evenly (2.5mm Allen wrench) to 6 to 8 inch-pounds of torque. (It is recommended to use the torque wrench available from Siemens, PN 1631005-003, which is calibrated at 7.2 inch pounds). Remove the assembled valve from the valve fixture.
10.	Reinstall the valve in the oven and connect all tubing.
11.	Power up and check for leaks. Verify valve operation by running chromatograms.

Model 20 Valve

Description

This section presents information to perform fault diagnostic testing, maintenance and repair and installation of the Model 20 Valve. To assure optimum valve operation, a clean contaminant free operating environment is required at all times.



1. Valve Cap
2. Allen Screws (3 total)
3. Belleville Washers (6 total)
4. Teflon Disc Seal Diaphragm
5. Dacron Cushion Diaphragm
6. Plungers (6 total)

12. Air Loaded (Upper) Piston
13. Valve Plunger Body
14. Cylinder Base
15. Spring Loaded (Lower) Piston
16. Allen Screws (3 total)
17. Belleville Washers (6 total)
18. Inner (small) O-Ring
19. Outer (large) O-Rings
20. Large Belleville Washers (3 total)

Figure 4-30: Model 20 Valve Components

Maintenance Procedures

Maintenance procedures are divided into three phases as presented below. The type of maintenance procedure to be performed is determined by the type of fault, availability of spare parts, experience of maintenance personnel and availability of tools and work place facilities. The description accompanying each type of procedure will guide the user in the type of maintenance procedure to be performed.

Within the procedures, the numbers in parenthesis denote parts referenced in the list contained in Figure 4-30 above; refer back to the list for locations.

Diagnostic: These can determine problems by a visual examination of valve.

Mini-Maintenance: Mini-Maintenance procedures should be performed with the Model 20 Valve installed in the analyzer. These procedures are the first logical step for maintenance personnel if they are not sure of what the problem is.

If these procedures fail to correct problem with a faulty valve, or visual inspection detects an appreciable amount of foreign contamination on the diaphragm, it is recommended that the valve be returned to Siemens for repair. Procedures include the following:

- Valve Cap Disassembly
- Cleaning Fittings and Tubing
- Valve Cap Assembly

Maxi-Maintenance: These are procedures which may be performed if the valve fault cannot be corrected using Mini-Maintenance procedures. The valve can either be replaced or the following procedures can be performed. This includes completely disassembling, cleaning, and rebuilding of the entire valve. Procedures include the following:

- Valve Cap Disassembly
- Cleaning Fittings and Tubing
- Valve Cap Assembly
- Actuator Disassembly
- Actuator Assembly

Visual Valve Inspection

If system operational performance or a visual inspection of the Model 20 Valve indicates a real or potential problem with the valve, the following information will assist maintenance personnel in determining whether the valve can be repaired on site or whether it should be returned to Siemens for repair or replacement.

Maintenance Personnel

If customer maintenance personnel are not technically trained to repair the valve on site, it is recommended that the valve be returned to Siemens for repair or direct replacement.

Direct Valve Replacement

If it is determined that the problem is directly related to Model 20 Valve system performance, the customer must make a determination if the valve can be repaired on site or if it should be returned to Siemens for repair or replacement.

Repair of Valve

To repair the valve on site, the customer must have the necessary maintenance tools and replacement parts. Recommended valve spare parts including the Model 20 repair kit (PN K21000), can be obtained from Siemens.

Maintenance Facility

When cleaning the valve and associated components, it is imperative that the maintenance be performed in a clean and contaminant free facility. Components should be placed on a lint free cloth to prevent impurities from comtaminating the valve and/or components. Hands should be clean and free of contaminants.

Presence of any foreign contamination can cause additional valve problems after reinstallation.

All foreign contamination adhering to valve must be removed quickly using a dust/lint free cloth and a cleaning solvent such as hexane. After cleaning valve cap and tubing, shake excess cleaning fluid from tubes and let valve cap air dry before reassembling.

CAUTION ⚠

Do not allow polished face of valve cap to rest on any surface other than a lint free cloth. Clean metal parts using only a syringe and a cleaning solvent such as hexane, acetone, or methanol.

Diagnostic Procedures

Depending on the installation, the following tests can be performed with the valve mounted within the analyzer. Other tests require the analyzer to be shut down and valve ports disconnected. These diagnostic tests indicate specific areas of the fault or trouble.

Valve Leakage

Sample Pressures Lower Than Carrier Pressure: Leakage may be from a carrier port to a sample port within the valve regardless of whether valve is actuated or deactivated. With sample inlet flow turned off, sample outlet should be zero. Check carrier and sample gas for leakage.

Carrier and Sample Gas Leakage: Bubbles indicate internal leakage. For a liquid carrier, check for liquid dripping from sample outlet tube.

Sample Pressure Higher Than Carrier: Leakage between ports is visually displayed on analyzer recorder as a baseline shift when sample pressure is removed from valve.

Plugged Valve

If the valve is plugged, plungers are pressed upward by air pressure or spring action and will not release to their ***open*** position when sample pressure drops.

Ruptured Diaphragm

Escaping air from valve vent hole indicates a ruptured diaphragm (4), which must be replaced. Check for liquid substances escaping from the vent hole. Refer to Figure 4-31.

1. Valve Cap
2. Allen Screws (3 total)
3. Belleville Washers (6 total)
4. Teflon Disc Seal Diaphragm
5. Dacron Cushion Diaphragm
6. Plungers (6 total)

12. Air Loaded (Upper) Piston
13. Valve Plunger Body
14. Cylinder Base
15. Spring Loaded (Lower) Piston
16. Allen Screws (3 total)
17. Belleville Washers (6 total)
18. Inner (small) O-Ring
19. Outer (large) O-Rings
20. Large Belleville Washers (3 total)
21. Control Port (Upper, Middle, or Lower depending on location)

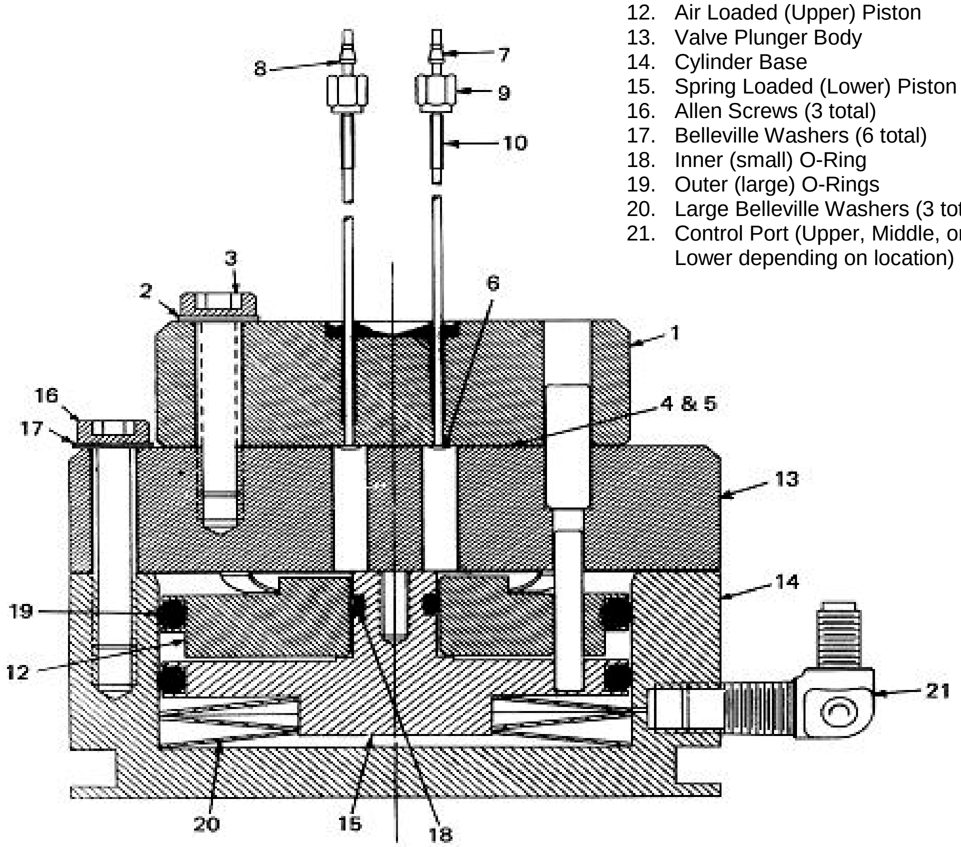


Figure 4-31: Section View of Model 20 Valve

Slow or Erratic Piston Switching

Improper lubrication and/or contamination of Bal-Seal (18) will increase friction on valve-actuating piston. This causes valve switching to be erratic, slow or inoperative. Refer to Figure 4-31. To correct the conditions causing slow or erratic piston switching, perform the following:

- Disassemble valve body
- Discard old O-ring
- Thoroughly clean all components
- Lubricate components per specifications
- Install new O-ring
- Reassemble the valve

Additional Faults

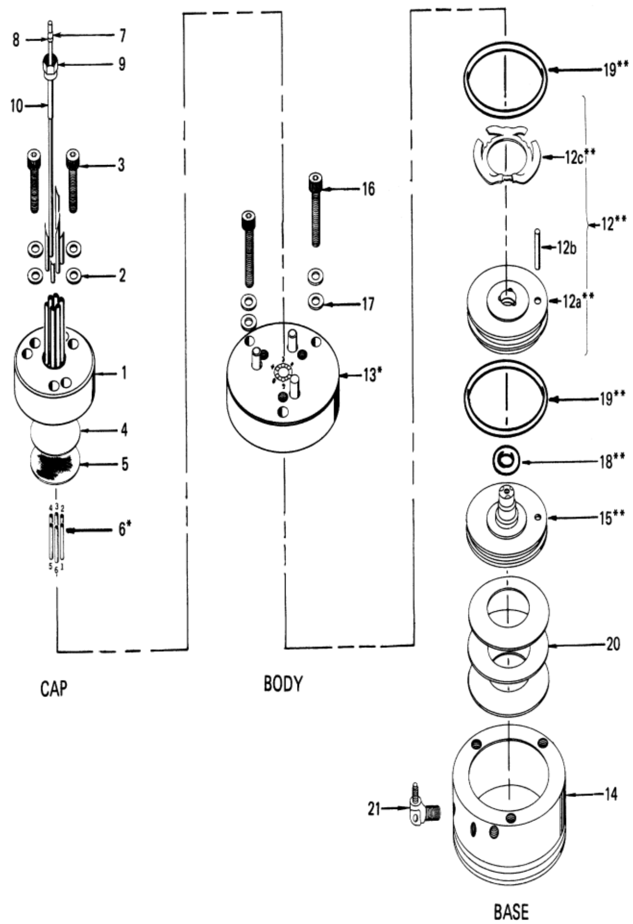
The following additional conditions can be visually observed without the valve being removed or disassembled:

- Port-to-Port Leakage
- Low Flow Rate (plugging)
- Double Sampling and other
- Sample Flow Problems

More serious conditions do require the valve to be disassembled. Procedures for disassembling the Valve are presented in the following sections.

Mini-Maintenance Procedures

The following procedures should be followed for performing Mini-Maintenance on the Model 20 Valve. Refer to Figures 4-31 and 4-32.



1. Valve Cap
2. Allen Screws (3 total)
3. Belleville Washers (6 total)
4. Teflon Disc Seal Diaphragm
5. Dacron Cushion Diaphragm
6. Plungers (6 total)

12. Air Loaded (Upper) Piston
13. Valve Plunger Body
14. Cylinder Base
15. Spring Loaded (Lower) Piston
16. Allen Screws (3 total)
17. Belleville Washers (6 total)
18. Inner (small) O-Ring
19. Outer (large) O-Rings
20. Large Belleville Washers (3 total)
21. Control Port (Upper, Middle, or Lower depending on location)

Figure 4-32: Exploded View of Model 20 Valve

Valve Cap Disassembly and Cleaning

Step	Procedure
1.	Loosen the three Allen screws (16), holding the plunger valve body (13) to the valve cylinder base (14). The screws should be loosened to the point that most of the spring pressure is relieved (approximately 1/8" or 3.2 mm). **<u>DO NOT</u> REMOVE THE THREE ALLEN MOUNTING SCREWS.**
2.	To remove valve cap (1), remove the three Allen screws (3) and six Belleville washers (2) holding the valve cap (1) to the valve plunger body (13).
3.	Remove the valve cap (1) from the plunger valve body (17).

CAUTION ⚠

Do not place polished valve cap (1) against any abrasive surface. Place it on a lint free cloth free of foreign contaminants.

4.	Inspect the valve cap *Teflon base* seal disc diaphragm (4) and the *Dacron* disc cushion diaphragm (5) for dirt, contamination or breaks. Regardless of whether damage or contamination is evident, discard old seal and cushion, and replace them with new component(s).

NOTE

If seal disc diaphragm (4) is brittle and dirty but not ruptured, or if it is ruptured but clean, **DO NOT** disassemble the rest of the valve.

5.	Visually inspect the rest of valve. If it is clean and in good condition, install a new disc seal diaphragm (4) and cushion diaphragm (5). To reassemble the valve cap, perform the following procedures.

Cleaning Fittings & Tubing

All fittings and tubing must be cleaned and valve diaphragms inspected for cleanliness, and for catalyst or polymer buildup in the valve cap. Plunger valve body faces should be wiped clean using hexane, acetone, or methanol and a lint free cloth. If port-to-port leakage or blockage exists when a valve flow passage is switched open, then contamination of flow passages or excessive friction in the lower section of the valve may exist. This impedes valve operation and the valve must be thoroughly flushed clean.

Step	Procedure
6.	Prepare a large syringe with a Tygon tubing adapter installed. Fill syringe with a recommended cleaning solvent.

NOTE

An ultrasonic cleaner filled with a recommended cleaning solvent is recommended for cleaning all components. Solvent must not leave any residue on evaporation.

If solvent becomes contaminated during cleaning, it must be replaced with a clean supply.

7.	Clean valve cap while it is disassembled. Using syringe, flush solvent through each port in the valve cap.

CAUTION

When reassembling the valve cap, always install a new *Teflon* Seal Disc diaphragm (4) and *Dacron* Cushion Disc (5) on plunger valve body (13). Do not install the previously used *Teflon* Seal (4) and/or *Dacron* Cushion Disc (5). Before reinstalling seal and cushion on plunger valve body, remove lint and any dust particles.

Valve Cap Assembly

8.	Place the actuator assembly upright on a clean lint free cloth surface. Refer to Figures 4-31 and 4-32.
9.	Position the Dacron cushion disc diaphragm (5) between the three alignment pins on the plunger valve body (13).
10.	Using tweezers, hold *Teflon* seal disc diaphragm (4) by its edges. Before reinstalling disc, remove lint, dust and oils by sliding disk between your index and middle fingers.
11.	Install *Teflon* seal disc diaphragm (4) over the *Dacron* diaphragm disc cushion (5).

Step	Procedure
12.	Align valve cap (1) over the three guide pins of the valve plunger body (13). Port 1 must be placed toward the upper control port.
13.	Lower valve cap (1) over plunger valve body plunger guide pins (13) then install valve cap (1) onto the plunger valve body.
14.	Install, but do not securely tighten, the three Allen screws (3) each with two Belleville lock washers (2).

NOTE

To assure proper tightness in the following two steps, it is recommended to use the torque wrench available from Siemens, PN 1631005-002, which can be adjusted over the range of torque measurements listed below.

15.	Referring to the following screw tightening rotation sequence, securely tighten the three Allen screws (3) that connect the valve cap (1) to the valve plunger body (13). One at a time, tighten each screw to first torque. Then continue with the next torque value until the final value is reached. a. Finger tighten b. 20 inch pounds (2.3 Nm) c. 40 inch pounds (4.5 Nm) d. 60 inch pounds (6.8 Nm)
16.	Tighten the three Allen screws (16) that secure the plunger valve body (13) to the cylinder base (14) to approximately 30 to 40 inch-pounds (3.4 to 4.5 Nm). **BE CERTAIN ALL THREE ALLEN SCREWS ARE SECURELY TIGHTENED. DO NOT OVERTIGHTEN.**

Maxi-Maintenance Procedures

The following procedures should be followed for performing Maxi-Maintenance on Model 20 Valve. Maxi-Maintenance procedures include the Mini-Maintenance procedures in addition to the disassembly, inspection and assembly of the valve Actuator presented in this section. Refer to Figures 4-31 and 4-32.

Actuator Disassembly

Step	Procedure
1.	Perform the following Maxi-Maintenance procedures in the order presented. • Valve Cap Disassembly (Mini-Maintenance) • Cleaning Fittings and Tubing (Mini-Maintenance) • Actuator Disassembly (Maxi-Maintenance) • Actuator Assembly (Maxi-Maintenance) • Valve Cap Assembly (Mini-Maintenance)
2.	Check valve plungers (6) for sticking.
3.	Using even finger pressure around edges of plunger valve body (13), push valve plunger body against cylinder valve base (14). All six plungers should rise.
4.	Release plunger valve body (13). The six plungers should drop. If plungers do not drop, check for oil film on plungers. This can prevent plungers from dropping.
5.	Apply gentle pressure to the top of each of the six plungers. If plungers drop, without excessive pressure, the valve is operating normally and does not require additional disassembly. If plungers stick or are sluggish in their operation, they must be thoroughly cleaned with a recommended cleaning solvent, repaired, or the entire actuator must be replaced.
6.	Turn actuator on its side. Remove the three screws (16) which secure the plunger valve body (13) to the cylinder valve base (14).

NOTE

When performing the following procedure, **DO NOT** allow actuator plungers to fall from plunger valve body (13).

Step	Procedure
7.	With plunger valve body (13) in the horizontal position, remove the assembly. Carefully remove all six plungers (6).
8.	Place cylinder valve base (14) in upright position. Insert a 6-32 hex threaded standoff screw into the center-threaded hole and pull to remove air loaded piston (12) and spring-loaded piston (15).

NOTE

An alternate method for removing the actuator piston assembly is presented in step 9. If this method is not used, proceed to step 10.

9.	Carefully apply 10 psig (70 kPa) air pressure on bottom port of cylinder valve base (14). This extends the pistons allowing them to be pulled out of cylinder valve base by hand. **DO NOT USE MORE THAN 30 PSIG (210 KPA) OF AIR PRESSURE WHEN USING THIS METHOD.**
10.	Inspect actuator cylinder walls and the three Belleville washers (20). These components **MUST BE** clean and show no evidence of damage. If necessary, clean parts or replace them.
11.	Separate the upper air loaded piston (12) and lower spring loaded piston (15). Inspect pistons (12 and 15), silicone O-rings (18 and 19) and finger loaded valve spring (12c). These components **must be** clean and show no evidence of damage. If necessary, clean parts or replace them.

NOTE

It is extremely important that, when reassembling the actuator, the assembly area be clean and dust free. Hands of maintenance personnel must be clean and not oily and tools must also be clean.

Be certain valve cap (1) does not rest on abrasive surface and valve cap has completely air dried before reassembly. Rest valve cap on a clean lint free cloth.

Actuator Assembly

Step	Procedure
12.	Install the three large Belleville washers (20) in cylinder valve base (14). Washers must be positioned in an alternating bevel up, bevel down manner (to form a spring). Refer to Figures 4-31 and 4-32.
13.	Apply a bead of Krytox 240 AC lubricant, or equivalent; in "O" ring grooves of spring-loaded piston (15).
14.	Install new silicon O-rings (18 and 19) in spring loaded pistion (15) and apply a coating of lubricant over each "O" ring.
15.	Apply bead of lubricant in upper groove of air loaded piston (12a).
16.	Install a new silicon "O" ring (19) in the upper air loaded piston (12a) and apply a coating of lubricant over the "O" ring.
17.	Place upper piston (12a) over the small diameter of lower piston (15). Position pistons using guide pin (12b) for proper orientation.
18.	Apply Krytox 240C lubricant to each of the six finger spring (12c) pressure points. This is the point where the spring fingers contact the plunger body (13).
19.	Position the valve upright with its three ports on the left. Install a #6-32 screw in the center-threaded hole of air loaded piston assembly (12) and bottom spring-loaded piston (15).
20.	Lift the combined assembly (12 and 15), and orient it with the upper piston guide pin (12b) facing toward maintenance person.
21.	Press the piston assembly into the cylinder base (14). After installation, remove the #6-32 screw.
22.	Align plunger valve body (13) and insert the piston guide pin (12b) into one of the three bottom holes of plunger valve body (13).
23.	Rotate plunger valve body (13) to align body screw holes with cylinder base (14) threaded holes.
24.	Install three #10-32 7/8" socket head screws (16) and Belleville washers (17).

Step	Procedure
25.	Hand tighten screws. **DO NOT** compress the Belleville washers (20) into the cylinder base (14).
26.	Install six plungers (6) into the plunger valve body (13). Plunger recess must face up.

NOTE

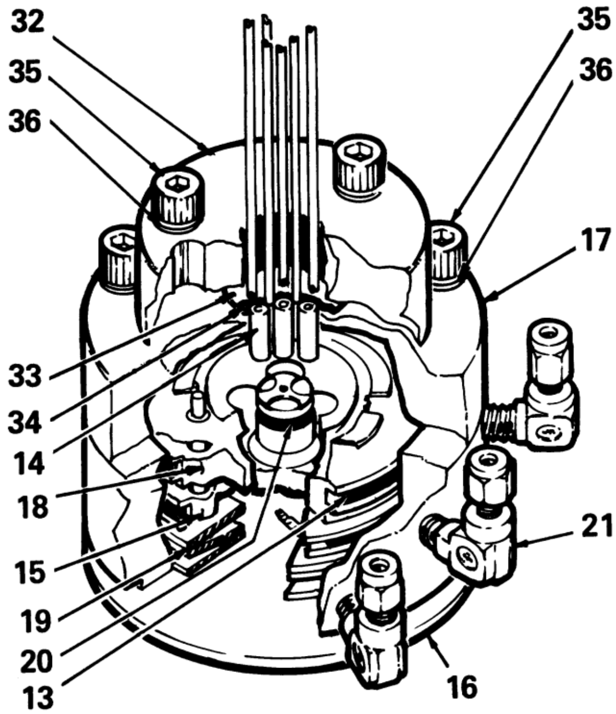
A clean plunger will fall with its own weight, and, when dropped into the valve body (13), it will bounce.

27.	Place a small drop of Krytox 143 AY or equivalent oil on each plunger.
28.	Using a pair of tweezers, lift each plunger up and down to allow the oil to flow around a plunger.
29.	Refer back to the previous procedure for reassembly of the valve cap.

Model 20 High Temperature Valve (HTV)

Description

This section presents the user with the necessary information to perform fault diagnostic testing, maintenance and repair, and installation of the Model 20 High Temperature Valve (HTV). The valve is actuated by air pressure. To assure optimum valve operation, a clean contaminant free operating environment is required at all times.



13. Outer (Large) Bal-Seals (2 total)
14. Plungers (6 total)
15. Spring Loaded (Lower) Piston
16. Cylinder Base
17. Valve Plunger Body
18. Air Loaded (Upper) Piston
19. Large Belleville Washers (3 total)
20. Inner (Small) Bal-Seal
21. Control Port (Upper, Middle, or Lower depending on location)

32. Valve Cap
33. Teflon Disc Seal Diaphragm
34. Nomex Cushion Diaphragm
35. Allen Screws (6 total)
36. Belleville Washers (12 total)

Figure 4-33: Model 20 High Temperature Valve (HTV) Components

Maintenance Procedures

Maintenance procedures are divided into three phases as presented below. The type of maintenance procedure to be performed is determined by the type of fault, availability of spare parts, experience of maintenance personnel and availability of tools and work place facilities. The description accompanying each type of procedure will guide the user in the type of maintenance procedure to be performed.

Within the procedures, the numbers in parenthesis denote parts referenced in the list contained in figure 4-33 above; refer back to the list for locations.

Diagnostic: These can determine problems by a visual examination of the valve.

Mini-Maintenance: Mini-Maintenance procedures should be performed with the Model 20 High Temperature Valve (HTV) installed in the analyzer. These procedures are the first logical step for maintenance personnel if they are not sure of what the problem is.

If these procedures fail to correct problem with a faulty valve, or visual inspection detects an appreciable amount of foreign contamination on the diaphragm, it is recommended that the valve be returned to Siemens for repair. Procedures include the following:

- Valve Cap Disassembly
- Cleaning Fittings and Tubing
- Valve Cap assembly

Maxi-Maintenance: These are procedures, which may be performed if the valve fault cannot be corrected using Mini-Maintenance procedures. The valve can either be replaced or the following procedures can be performed. This includes completely disassembling, cleaning, and rebuilding of the entire valve. Refer to Figure 4-33. Procedures include the following:

- Valve Cap Disassembly
- Cleaning Fittings and Tubing
- Valve Cap Assembly
- Actuator Disassembly
- Actuator Assembly

Visual Valve Inspection

If system operational performance or a visual inspection of the Model 20 High Temperature Valve (HTV) indicates a real or potential problem with the valve, the following information will assist maintenance personnel in determining whether the valve can be repaired on site or whether it should be returned to Siemens for repair or replacement.

Maintenance Personnel

If customer maintenance personnel are not technically trained to repair the valve on site, it is recommended that the valve be returned to Siemens for repair or direct replacement.

Direct Valve Replacement

If it is determined that the problem is directly related to Model 20 High Temperature Valve (HTV) system performance, the customer must make a determination if the valve can be repaired on site or if it should be returned to Siemens for repair or replacement.

Repair of Valve

To repair the valve on site, the customer must have the necessary maintenance tools and replacement parts. Recommended valve spare parts including the Model 20 HTV repair kit (PN K21021), can be obtained from Siemens.

Maintenance Facility

When cleaning the valve and associated components, it is imperative that the maintenance be performed in a clean and contaminant free facility. Components should be placed on a lint free cloth to prevent impurities from contaminating the valve and/or components. Hands should be clean and free of contaminants.

Presence of any foreign contamination can cause additional valve problems after installation.

All foreign contamination adhering to valve must be removed quickly using a dust/lint free cloth and a cleaning solvent, such as hexane, acetone or methanol. After cleaning valve cap and tubing, shake excess cleaning fluid from tubes and let valve cap air dry before reassembling.

CAUTION ⚠

Do not allow polished face of valve cap to rest on any surface other than a lint free cloth. Clean metal parts using only a syringe and a cleaning solvent such as hexane, acetone, or methane.

Diagnostic Procedures

Depending on the installation, the following tests can be performed with the valve mounted within the analyzer. Other tests require the analyzer be shut down and valve ports disconnected. These diagnostic tests indicate specific areas of the fault or trouble.

Valve Leakage

Sample Pressures Lower Than Carrier Pressure: Leakage may be from a carrier port to a sample port within the valve regardless of whether valve is actuated or deactivated. With sample inlet flow turned off, sample outlet should be zero. Check carrier and sample gas for leakage.

Carrier and Sample Gas Leakage: Bubbles indicate internal leakage. For a liquid carrier, check for liquid dripping from sample outlet tube.

Sample Pressures Higher Than Carrier: Leakage between ports is visually displayed on analyzer recorder as a baseline shift when sample pressure is removed from valve.

Plugged Valve

If the valve is plugged, plungers are pressed upward by air pressure or spring action and will not release to their ***open*** position when sample pressure drops.

Ruptured Diaphragm

Escaping air from valve vent hole indicates a ruptured diaphragm (33), which must be replaced. Check for liquid substances escaping from the vent hole. Refer to Figure 4-34.

Slow or Erratic Piston Switching

Improper lubrication and/or contamination of Bal-Seals will increase friction on valve-actuating piston. This causes valve switching to be erratic, slow or inoperative. Refer to Figure 4-34.

13. Outer (Large) Bal-Seals (2 total)
14. Plungers (6 total)
15. Spring Loaded (Lower) Piston
16. Cylinder Base
17. Valve Plunger Body
18. Air Loaded (Upper) Piston
19. Large Belleville Washers (3 total)
20. Inner (Small) Bal-Seal
21. Control Port (Upper, Middle, or Lower depending on location)

32. Valve Cap
33. Teflon Disc Seal Diaphragm
34. Nomex Cushion Diaphragm
35. Allen Screws (6 total)
36. Belleville Washers (12 total)

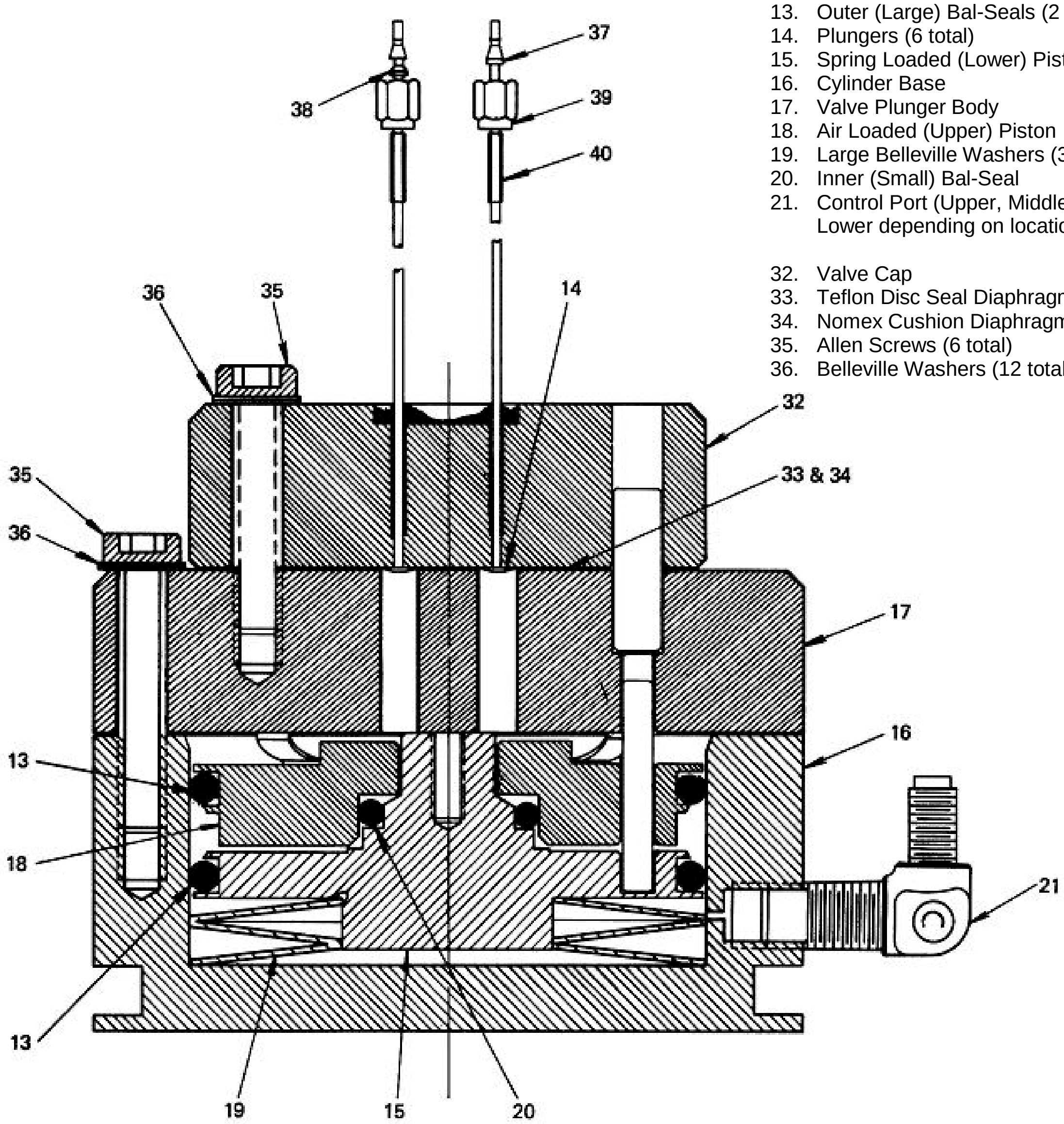


Figure 4-34: Section View of Model 20 HTV

Additional Faults

The following additional conditions can be visually observed without the valve being removed or disassembled:

- Port-to-Port Leakage
- Low Flow Rate (plugging)
- Double Sampling and other
- Sample Flow Problems

More serious conditions do require the valve to be disassembled. Procedures for disassembling the Valve are presented in the following sections.

Mini-Maintenance Procedures

The following procedures should be followed for performing Mini-Maintenance on the Model 20 HTV. Refer to Figure 4-34 and 4-35.

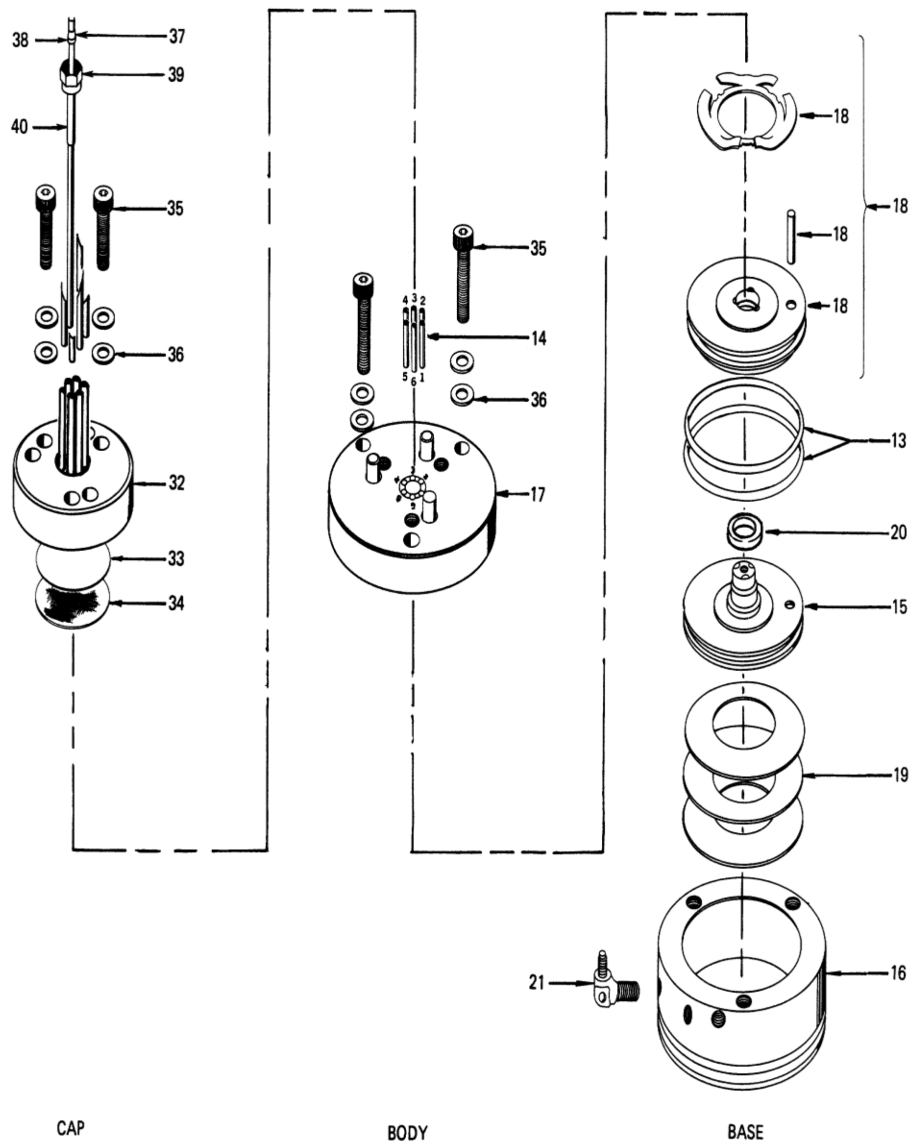
Valve Cap Disassembly and Cleaning

Step	Procedure
1.	Loosen the three Allen screws (35), holding the plunger valve body (17) to the valve cylinder base (16). The screws should be loosened to the point that most of the spring pressure is relieved (approximately 1/8” or 3.2 mm) **DO NOT REMOVE THE THREE ALLEN MOUNTING SCREWS.**
2.	To remove valve cap (32), remove the three Allen screws (35) and six Belleville washers (36) holding the valve cap (32) to the valve plunger body (17).
3.	Remove the valve cap (32) from the plunger valve body (17).

CAUTION ⚠

Do not place polished valve cap (32) against any abrasive surface. Place it on a lint free cloth free of foreign contaminants.

Model 20 High Temperature Valve (HTV), Continued



13. Outer (Large) Bal-Seals (2 total)
14. Plungers (6 total)
15. Spring Loaded (Lower) Piston
16. Cylinder Base
17. Valve Plunger Body
18. Air Loaded (Upper) Piston
19. Large Belleville Washers (3 total)
20. Inner (Small) Bal-Seal
21. Control Port (Upper, Middle, or Lower depending on location)

32. Valve Cap
33. Teflon Disc Seal Diaphragm
34. Nomex Cushion Diaphragm
35. Allen Screws (6 total)
36. Belleville Washers (12 total)

Figure 4-35: Exploded View of Model 20 HTV

Step	Procedure
4.	Inspect the *Teflon* seal disc diaphragm (33) and the Nomex cushion diaphragm (34). Examine valve cap base seal (33) and cushion diaphragm (34) subassembly's for dirt, contamination or breaks. Regardless of whether damage or contamination is evident, discard old seal and cushion, and replace them with new component(s).

NOTE

If seal disc diaphragm (33) is brittle and dirty, but not ruptured or if it is ruptured but clean, **DO NOT** disassemble the rest of the valve.

5.	Visually inspect the rest of valve. If it is clean and in good condition, install a new seal disc diaphragm (33) and a Nomex cushion diaphragm (34). To reassemble the valve cap, perform the following procedures.

Cleaning Fittings & Tubing

All fittings and tubing must be cleaned and valve diaphragms inspected for cleanliness, and for catalyst or polymer buildup in the valve cap. Plunger valve body faces should be wiped clean using hexane, acetone, or methanol and a lint free cloth. If port-to-port leakage or blockage exists when a valve flow passage is switched open, then contamination of flow passages or excessive friction in the lower section of the valve may exist. This impedes valve operation and the valve must be thoroughly flushed clean. For cleaning parts, an ultrasonic cleaner is recommended.

6.	Prepare a large syringe with a Tygon tubing adapter installed. Fill syringe with a recommended cleaning solvent.

NOTE

If solvent becomes contaminated during cleaning, it must be replaced with a clean supply.

7.	Clean valve cap while it is disassembled. Using syringe, flush solvent through each port in the valve cap.

Valve Cap Assembly

Step	Procedure
8.	Place the actuator assembly upright on a clean lint free cloth surface. Refer to Figures 4-34 and Figure 4-35.

CAUTION

⚠

When reassembling the valve cap, always install a new *Teflon* Seal Disc diaphragm (33) and *Nomex* Cushion Disc (34) on plunger valve body (17). Do not install the previously used *Teflon* Seal (33) and/or *Nomex* Cushion Disc (34). Before reinstalling seal and cushion on plunger valve body, remove lint and any dust particles.

9.	Position the Nomex cushion disc diaphragm (34) between the three alignment pins on the plunger valve body (17).
10.	Using tweezers, hold *Teflon* seal disc diaphragm (33) by its edges. Before reinstalling disc, remove lint, dust and oils by sliding disk between your index and middle fingers.
11.	Install *Teflon* seal disc diaphragm (33) over the Nomex disc cushion diaphragm (34).
12.	Align valve cap (32) over the three guide pins of the valve plunger body (17). Port 1 must be placed toward the upper control port.
13.	Lower valve cap (32) over valve plunger body guide pins (17) then install valve cap (32) onto the plunger valve body.
14.	Install, but do not securely tighten the three Allen screws (35), each with two Belleville lock washers (36), that secure the valve cap (32) to the valve plunger body (17).

NOTE

To assure proper tightness in the following two steps, it is recommended to use the torque wrench (PN 1631005-002) and bit (PN 1631005-701) which are available from Siemens and can be adjusted over the range of torque measurements listed below.

Step	Procedure
15.	Referring to the following screw tightening rotation sequence, securely tighten the three Allen screws (35), that connect the valve cap (32) to the valve plunger body (17). One at a time, tighten each screw to first torque. Then continue with the next torque value until the final value is reached. a. Finger tighten b. 20 inch-pounds (2.3 N•m) c. 40 inch-pounds (4.5 N•m) d. 60 inch-pounds (6.8 N•m) **BE CERTAIN ALL THREE ALLEN SCREWS ARE SECURELY TIGHTENED. DO NOT OVERTIGHTEN.**
16.	Tighten the three Allen screws (35) that secure the plunger valve body (17) to the cylinder base (16) to approximately 30 to 40 inch-pounds (3.4 to 4.5 N•m).

Maxi-Maintenance Procedures

The following procedures should be followed for performing Maxi-Maintenance on Model 20 HTV . Maxi-Maintenance procedures include the Mini-Maintenance Procedures in addition to the disassembly, inspection and assembly of the valve Actuator presented in this section.

CAUTION ⚠

The Model 20 HTV Repair Kit (PN K21021) available from Siemens includes adapters required for use during actuator reassembly. Failure to use the proper tools may cause damage to the Bal-Seals.

Actuator Disassembly

Step	Procedure
1.	Perform the following Maxi Maintenance procedures in the order presented: • Valve Cap Disassembly (Mini-Maintenance) • Cleaning Fittings and Tubing (Mini-Maintenance) • Actuator Disassembly (Maxi-Maintenance) • Actuator Assembly (Maxi-Maintenance) • Valve Cap Assembly (Mini-Maintenance)

Step	Procedure
3.	Check valve plungers (14) for sticking.
4.	Using even finger pressure around edges of plunger valve body (17), push valve plunger body against cylinder valve base (16). All six plungers should rise.
5.	Release plunger valve body (17). The six plungers should drop. If plungers do not drop, check for oil film on plungers. This can prevent plungers from dropping.
6.	Apply gentle pressure to the top of each of the six plungers. If plungers drop, without excessive pressure, the valve is operating normally and does not require additional disassembly. If plungers stick or are sluggish in their operation, they must be thoroughly cleaned with a recommended cleaning solvent such as hexane, repaired, or the entire actuator must be replaced.
7.	Turn actuator on its side. Remove the three socket head screws (35) which secure the plunger valve body (17) to the cylinder valve base (16).

NOTE

When performing the following procedure, **DO NOT** allow actuator plungers to fall from plunger valve body (17).

7.	With plunger valve body (17) in the horizontal position, remove the assembly. Carefully remove all six plungers (14).
8.	Place cylinder valve base (16) in upright position. Insert a 6-32 hex threaded standoff screw into the center-threaded hole and pull to remove air loaded piston (18) and spring-loaded piston (15).

NOTE

An alternate method for removing the actuator piston assembly is presented in step 9. If this method is not used, proceed to step 10.

9.	Carefully apply 10 psig (70 kPa) air pressure on bottom port of cylinder valve base (16). This extends the pistons allowing them to be pulled out of cylinder valve base by hand. **DO NOT USE MORE THAN 30 PSIG (210 KPA) OF AIR PRESSURE WHEN USING THIS MEHOD.**

Step	Procedure
10.	Inspect actuator cylinder walls and the three Belleville washers (19). These components **MUST BE** clean and show no evidence of damage. If necessary clean parts or replace them.
11.	Separate the upper air loaded piston (18) and lower spring loaded piston (15). Inspect pistons and spring loaded Bal-Seal (20) and Belleville washer (19). These components **MUST BE** clean and show no evidence of damage. If necessary clean parts or replace them.

CAUTION ⚠

Replace all Bal-Seals (20) if they have any nicks, scratches or any other type of deformations.

NOTE

It is extremely important that, when reassembling the actuator, the assembly area be clean and dust free. Hands of maintenance personnel must be clean and not oily and tools must also be clean.

Be certain valve cap (32) does not rest on abrasive surface and valve cap has completely air dried before reassembly. Rest valve cap on a clean lint free cloth.

Actuator Assembly

12.	Install the three large Belleville washers (19) in cylinder valve base (16). Washers must be positioned in an alternating bevel up, bevel down manner (to form a spring). Refer to Figures 4-34 and 4-35.
13.	Apply a bead of Krytox 240 AC lubricant, or equivalent, in Bal-Seal grooves of spring loaded piston (15)
14.	Lubricate outside diameter of assembly tool (Part Number A00145). Be certain spring-loaded Bal-Seal (13) is properly oriented with the associated spring facing up.
15.	Using an "O" ring as a cushion, push spring loaded Bal-Seal (13) down on the assembly tool until it snaps firmly into spring loaded piston (15) ring groove. Refer to Figure 4-36.

CAUTION ⚠

When installing Bal-Seals, handle them with extreme care, do not remove Bal-Seal springs for installation and do not nick or scratch Bal-Seals.

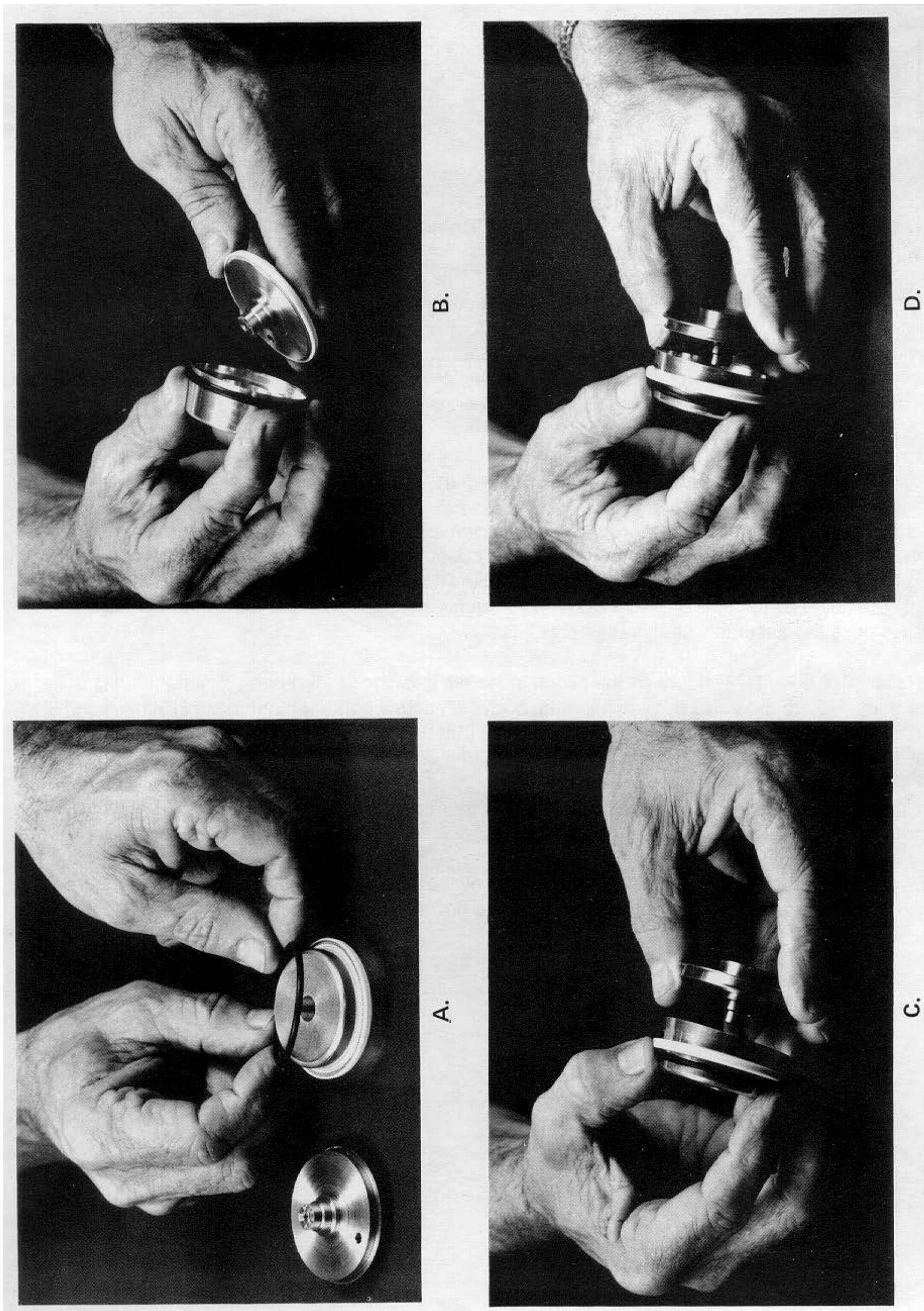
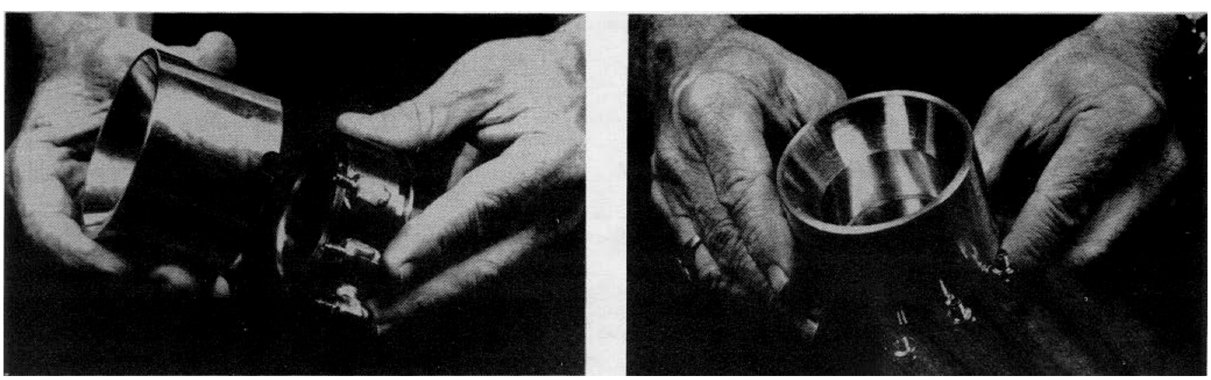


Figure 4-36: Assembling Bal-Seal (13) on Piston (15)

Step	Procedure
16.	Apply a bead of Krytox 240 AC lubricant, or equivalent, in both Bal-Seal grooves of air-loaded piston (18).
17.	Using pad of fingers or "O" ring as a cushion, install the small spring loaded Bal-Seal (20) in air loaded piston (18) groove with associated spring facing up. **DO NOT** use a fingernail. Refer to Figure 4-37.
18.	Push spring loaded Bal-Seal (20) to the bottom of groove.
19.	Apply small bead of Krytox 240 AC lubricant, or equivalent, on the small Bal-Seal sealing surface of lower spring loaded piston (15).
20.	Place upper air loaded piston (18) over the small diameter of lower piston (25). Position pistons using guide pin for proper orientation.
21.	Screw the assembly stud and washer into the threaded hole in the lower spring loaded piston (15) and evenly force the spring loaded Bal-Seal (20) over the bearing surface of lower spring loaded piston (15). **LEAVE THE ASSEMBLY STUD AND WASHER IN PLACE.**
22.	Moderately lubricate outsides of Bal-Seals with Krytox 240 AC lubricant, or equivalent. Also lubricate each of the six fingers of spring. This is where fingers contact plunger valve body (17).
23.	Position valve upright with the three ports on the left. Place assembly guide tool (Part Number T11000) on the valve, with the cutout on the lip of assembly tool over the upper tube fitting. Refer to Figure 4-38.
24.	Lift piston and Bal-Seal assembly and orient assembly with the upper piston index guide pin towards the maintenance person.
25.	Firmly, but evenly, press the piston and Bal-Seal assembly through the assembly guide tool into the cylinder valve base (16). Refer to Figure 4-39.
26.	Remove guide tool assembly stud and lock washer.
27.	Align plunger valve body (17) and insert piston index guide pin into one of the three bottom plunger valve body holes.

Figure 4-37: Installing Bal-Seal (20) in Piston Groove (18)



A. **B.**

Figure 4-38: Placing Assembly Guide Tool on Valve Base (16)

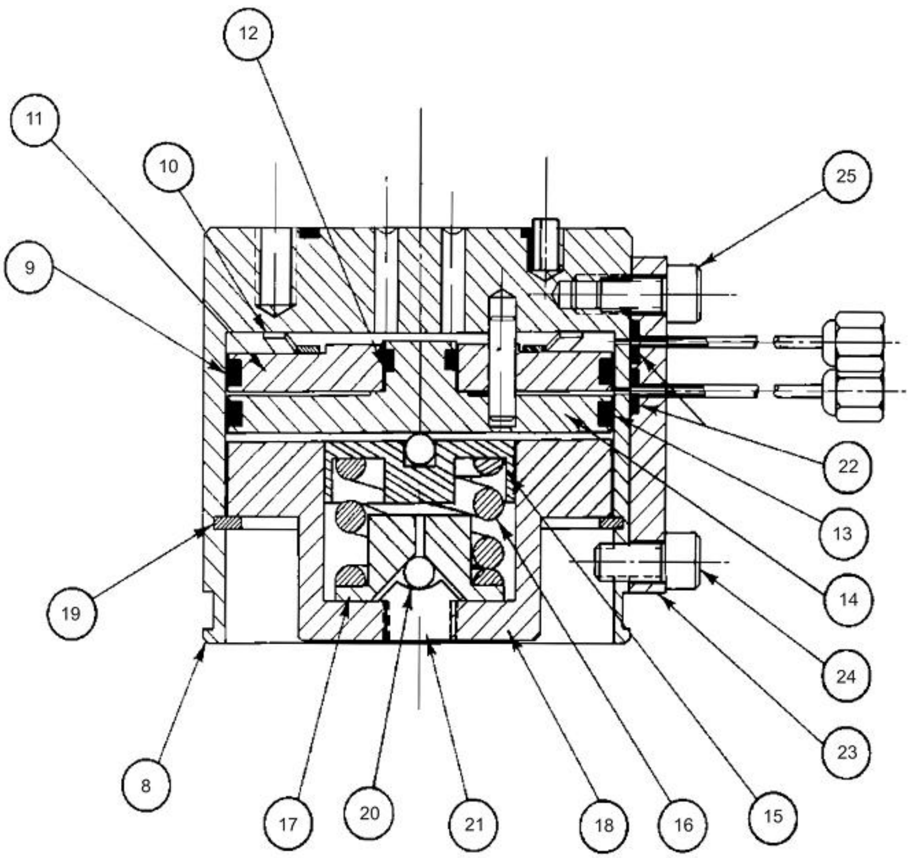
Figure 4-39: Inserting Piston Assembly (15 and 18) into Base (16)

Step	Procedure
28.	Rotate plunger valve body (17) to align the plunger valve body screw holes with cylinder valve base (16) threaded holes.
29.	Install three Allen screws (35) each with two Belleville washers (36). Hand tighten screws but **DO NOT** compress the Belleville washers (19) in cylinder valve base.
30.	With the recess facing up, install the six plungers (14) in the plunger valve body (17). A clean plunger will fall under its own weight and bounce when dropped into the plunger valve body.
31.	Place a small drop of Krytox 143 AY or equivalent oil on each plunger. Using a pair of tweezers lift each plunger and move it up and down to allow lubricating oil to flow around the plunger.
32.	Refer back to the previous procedure for reassembly of the valve cap.

Model 11 and Model 11 Low Dead Volume Valves

Description

This section presents the user with the necessary information to perform fault diagnostic testing, maintenance and repair and installation of the Model 11 Valve and the Model 11 Low Dead Volume Valves. These valves are actuated by air pressure. To ensure optimum valve operation, a clean contaminant free operating environment is required at all times. Refer to Figure 4-40.



8. Valve Body
9. O-Ring
10. Finger Spring of Air Loaded Piston
11. Air Loaded Piston
12. O-Ring
13. O-Ring
14. Spring Loaded Piston
15. Compensation Plate
16. Compression Spring
17. Compression Plate
18. Retaining Base
19. Retaining Ring Clip
20. Ball 5/32”
21. Set Screw
22. O-Rings (3 total)
23. Air Signal Manifold
24. Screw 3/8”
25. Screw 1/2”

Figure 4-40: Model 11 (or Model 11 LDV) Valve Without Valve Cap

Valve Types

This Model 11 valve is broken down into two primary types, the standard Model 11 Valve and the Model 11 Low Dead Volume (LDV) valve. Within this section, maintenance procedures for these two types of valve are the same except where noted. Further maintenance procedures for these valves, including port-to-port leak tests, are available in the Model 11 Valve Repair Manual (PN M06115) and the Model 11 LDV Valve Repair Manual (PN 2015584-001).

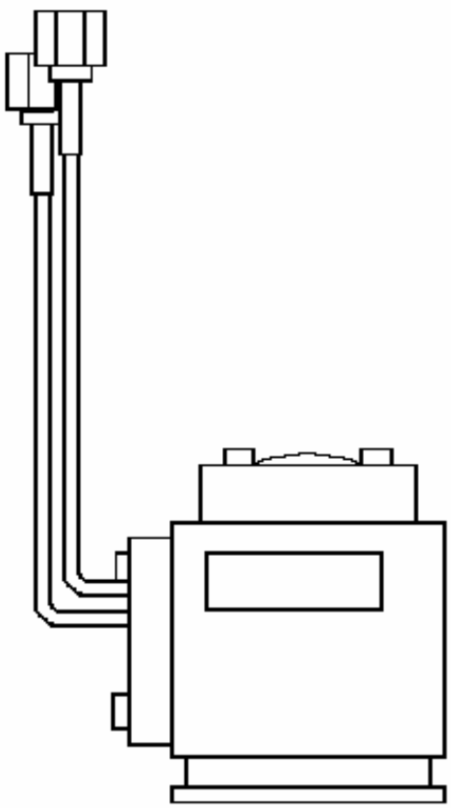


Figure 4-41: Model 11 LDV Valve

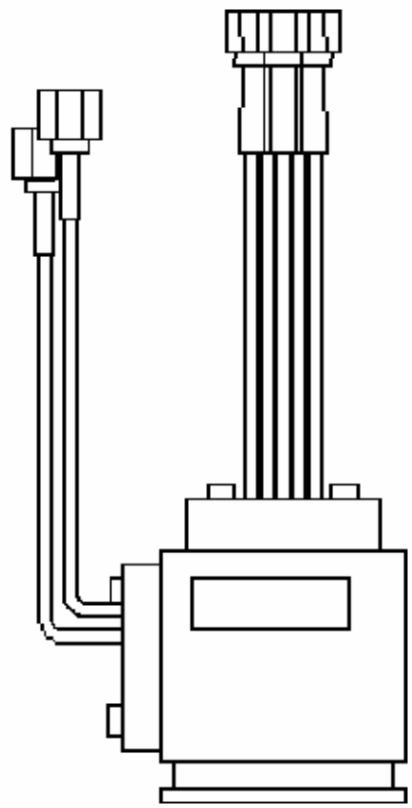


Figure 4-42: Model 11 Valve

NOTE

For maintenance purposes, the primary difference between the Model 11 and the Model 11 Low Dead Volume (LDV) valves is the sample ports on the valve cap. This can be seen in the figures above. There is an adapter tube (available from Siemens) that can be useful for some maintenance procedures involving the Model 11 LDV. None of the procedures in this section require the use of the adapter tube. For more information on the adapter tube, refer to the Model 11 LDV Repair Manual (PN 2015584-001).

Maintenance Procedures

Maintenance procedures are divided into three phases as presented below. The type of maintenance procedure to be performed is determined by the type of fault, availability of spare parts, experience of maintenance personnel and availability of tools and work place facilities. The description accompanying each type of procedure will guide the user in the type of maintenance procedure to be performed.

Within the procedures, the numbers in parenthesis denote parts referenced in the lists contained in the figures within this section; refer back to the lists for locations.

Diagnostic: These can determine problems by a visual examination of valve.

Mini-Maintenance: Mini-Maintenance procedures should be performed with the valve installed in the analyzer. These procedures are the first logical step for maintenance personnel if they are not sure of what the problem is.

The valve should be returned to Siemens for repair if procedures fail to correct problem of a faulty valve or a visual inspection detects an appreciable amount of foreign contamination on the diaphragm. Valve cap maintenance procedures are as follows:

- Valve Cap Disassembly
- Cleaning, Fittings and Tubing
- Valve Cap Assembly

Maxi-Maintenance: These procedures may be performed if the valve fault cannot be corrected using Mini-Maintenance procedures. The valve can either be replaced or these procedures can be performed. This includes completely disassembling, cleaning and rebuilding the entire valve. Procedures include the following:

- Valve Cap Disassembly
- Cleaning Fittings and Tubing
- Valve Cap Assembly
- Valve Body Disassembly
- Valve Body Cleaning
- Valve Body Assembly

Visual Inspection

If system operational performance or a visual inspection of the Model 11 or Model 11 Low Dead Volume Valve indicates the real or potential problem with the valve, the following information will assist maintenance personnel in determining the problem. Information will indicate whether the valve can be repaired on site or whether it should be returned to Siemens for repair or replacement.

Maintenance Personnel

If customer personnel are not technically trained to repair the valve on site, it is recommended that the valve be returned to Siemens for repair or direct replacement.

Direct Valve Replacement

If it is determined that the problem is directly related to Model 11 or Model 11 Low Dead Volum (LDV) Valve system performance, the customer must make a determination if the valve can be repaired on site or if it should be returned to Siemens for repair or replacement.

Repair of Valve

To repair the valve on site, the customer must have the necessary maintenance tools and replacement parts. Recommended valve spare parts including the Model 11 Valve repair kit (PN K21040) and Model 11 LDV repair kit (PN 2015581-001), can be obtained from Siemens.

If the Valve shows evidence of poor switching conditions, the following procedures should be performed.

- Disassemble the valve body
- Discard the old O-rings
- Install new O-rings
- Thoroughly clean all the components
- Lubricate components
- Reassemble the valve

Maintenance Facility

When cleaning the valve and associated components, it is imperative that the maintenance be performed in a clean and contaminant free facility. Components should be placed on a lint free cloth to prevent impurities from contaminating the valve and/or components. Hands should be clean and free of contaminants.

If valve maintenance is to be performed on site, the area must be clean and free of foreign contaminants. Presence of any foreign contamination can cause additional valve problems after reinstallation.

All foreign contamination adhering to valve must be removed quickly using a dust/lint free cloth and a cleaning solvent, such as hexane. After cleaning valve cap and tubing, shake excess cleaning fluid from tubes and let valve cap air dry before reassembling.

CAUTION ⚠

Do not allow polished face of valve cap to rest on any surface other than a lint free cloth. Clean metal parts using only a syringe and a cleaning solvent such as hexane, acetone, or methanol.

Diagnostic Procedures

Depending on the installation, the following tests can be performed with the valve mounted in the analyzer. Other tests require the analyzer be shut down and valve ports disconnected. These diagnostic tests indicate specific areas of the fault or trouble.

Valve Leakage

Vapor analyzers generally have the sample at atmospheric pressure, so any leakage would be from a carrier port to a sample port within the valve. With the sample inlet flow turned off, the sample outlet flow should be zero in either the "air off" or "air on" condition. Check for small leaks by immersing the sample outlet tubing in a beaker of water. Bubbles indicate internal leakage.

The liquid sample streams may have pressures several hundred pounds higher than the carrier gas. Leaking between ports will show up on the analyzer chromatogram as base-line shift when the sample pressure is removed from the valve.

Plugged Valve

Plungers in the valve are pressed upward by air or spring action, but when released depend on their own weight and sample pressure to drop them to the "open" position. Very small sample pressures 1 to 10 oz. (0.4 to 4.3 kPa) may be insufficient to open the flow path if the sealing disc has been held against the cap for a long time (such as a valve in storage). Check for flow across alternate flow paths, such as air on and air off. It may be necessary to temporarily increase the sample pressure to get the flow started, and then reduce it to normal after a few cycles.

Ruptured Sealing Disc

To test for a ruptured sealing disc apply air to valve ports, one at a time, while sealing off all others. Place a small amount of soap solution such as Leak Tec™ over the upper control port's bleed tube air signal manifold (23). Any escaping air at this point indicates a ruptured disc. If this occurs, proceed with a disc replacement.

If the disc does not appear to be ruptured, remove the valve from service and replace it with a new valve.

Slower Erratic Piston Switching

Excessive friction on the actuating pistons of the valve can be caused by lack of lubricant, or dirt or contamination on the O-rings. As a result, the valve may switch erratically, switch slowly or not switch at all. These conditions can cause a leak port to port, across the sealing disc, double sampling, or complete closing of flow between two or more ports.

Mini-Maintenance Procedures

The following procedures should be followed for performing Mini-Maintenance on Model 11 or Model 11 Low Dead Volume (LDV) Valve. Figures are of the Model 11 but are also applicable to the Model 11 LDV.

Valve Cap Disassembly

Step	Procedure
1.	Relieve the pressure on the base Allen Set Screw (21) by turning it counterclockwise until it turns easily. Refer to Figure 4-40.

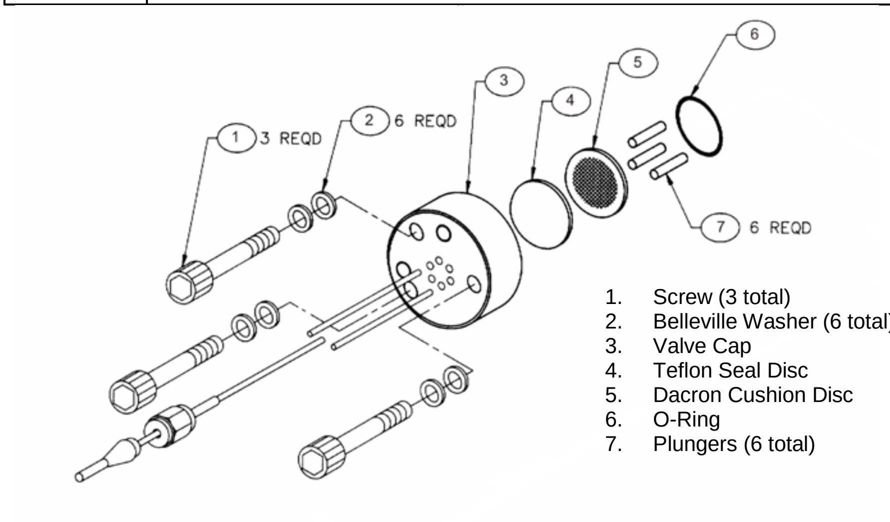


Figure 4-43: Model 11 Valve Cap Exploded View

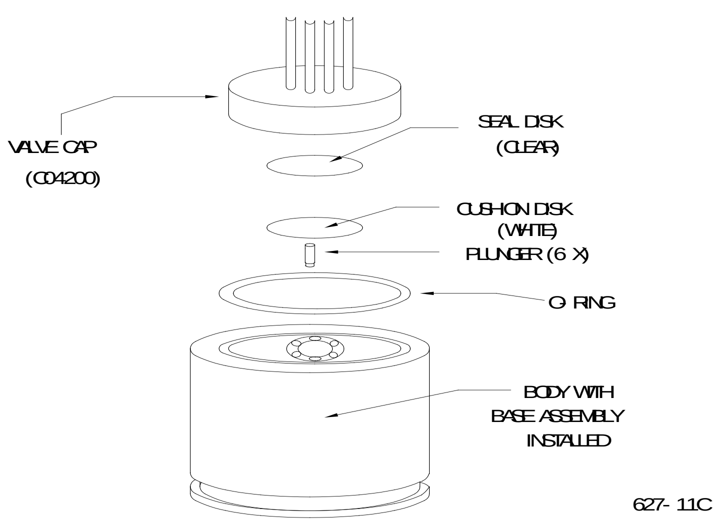


Figure 4-44: Model 11 Valve Major Components

Step	Procedure
2.	Remove the three Allen head cap socket screws (1) and separate the cap (3) from the valve body (8). When the valve cap is removed, the following components are exposed. Refer to Figures 4-43 and 4-44. • Teflon Sealing disc (4) [clear] • Dacron Cushion disc (5) [white] and • "O" ring (6)
3.	Inspect the Teflon sealing disc (4), Dacron cushion disc (5) and silicon rubber "O" ring (6) for dirt or breaks. If damage is evident, discard damaged part(s) and replace with new component(s).
4.	If Teflon sealing disc (4), Dacron cushion disc (5) and "O" ring (6) are brittle or dirty, but not ruptured, or they are ruptured but clean, visually inspect the rest of the valve. If it is clean and in good order, install new Teflon sealing disc (4), Dacron cushion disc (5) and "O" ring (6) and reassemble the cap. Otherwise, either continue with valve disassembly or replace the valve.
5.	Examine each of the six plungers (7) for evidence of damage or contamination. If damage is evident, discard defective plunger(s) and replace with new ones. Refer to Figure 4-45.
6.	To reassemble the valve cap (3), refer to section Valve Cap Assembly. If the valve actuating piston assembly is contaminated or malfunctioning, refer to Valve Body disassembly.

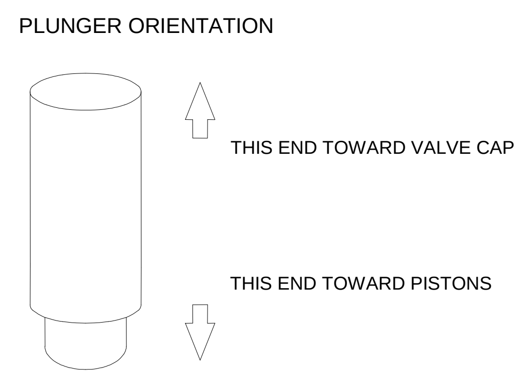


Figure 4-45: Model 11 Plunger Orientation

Cleaning Fittings and Tubing

All valve fittings and tubing must be clean and valve diaphragms inspected for cleanliness, catalyst or polymer buildup. Valve cap or plunger valve body faces should be wiped clean using hexane, acetone or methanol and a lint free cloth. If port-to-port leakage or blockage exists when a valve flow passage is switched open, then contamination of flow passages or excessive friction in the lower section of the valve may exist. This impedes valve operation and the valve must be thoroughly flushed clean.

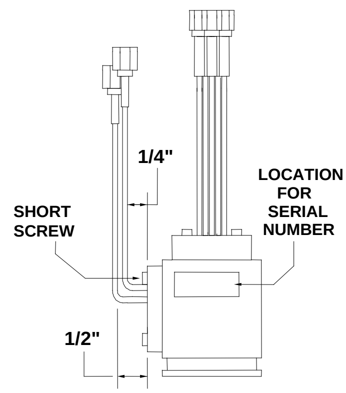


Figure 4-46: Manifold Tube

NOTE

If solvent becomes contaminated during performance of the following steps, it must be replaced with a clean supply from a clean beaker. Clean solvent must be used for each of the following steps.

Step	Procedure
7.	(For the Model 11 LDV Valve) - Clean the valve cap (3) while disassembled and visually verify that ports are clear. Use of an ultrasonic cleaner and an appropriate solvent such as hexane is recommended.
8.	(For Model 11 Valve) – Clean valve cap (3) while disassembled using a syringe and appropriate solvent. Clean each port and attached tubing on the valve cap by flushing solvent back and forth through each port while cap is immersed in a beaker of solvent.

Valve Cap Assembly

Step	Procedure
9.	Place the actuator assembly upright on a clean lint free cloth surface with the two valve cap guide pins facing upwards.
10.	Using a syringe with Krytox 143 AY lubricating oil, place a drop of oil on sidewall of each valve body (8) plunger hole.
11.	Reinstall the six plungers (7) into their valve body positions. Using tweezers, move each plunger up and down to thoroughly lubricate them. Plungers must not protrude above valve body (8) top surface. Refer to Figure 4-45 for plunger orientation.
12.	Using clean lint free cloths wetted with acetone, remove excess lubricating oil from top of valve body (8).

CAUTION ⚠

When installing "O" ring (6), Dacron cushion disc (5) and clear Teflon seal disc (4), do not use any type of grease as a lubricant. There must be no foreign contaminants on discs.

13.	Install silicon "O" ring (6), Dacron cushion disc (5) and clear Teflon seal disc (4). Do not lubricate "O" ring (6).

NOTE

Clear Teflon seal disc (4) MUST BE mounted on top of Dacron cushion disc (5). Refer to Figure 4-44. Align discs over plungers (7).

14.	Securely holding valve cap (3), blow out each port and/or tube with compressed air to remove all acetone and foreign matter.

CAUTION ⚠

Do not use grease when installing O-ring.

Step	Procedure
15.	It is recommended that appropriate torque wrenches be used for this step (available from Siemens – PN's 1631005-002 and 1631005-003). Install valve cap (3) using the three 10-32 Allen screws (1). Screws must be tightened evenly in sequence 1, 2, 3, 1 sequence. Tightening steps are as follows. Refer to Figure 4-43. • Run screws down until they contact valve cap. • Tighten screws with Allen driver until they are finger tight. • Tighten screws to approximately 15 inch pounds (1.69 Nm). This is a ¼ turn maximum. • Tighten screws to approximately 20 inch pounds (2.26 Nm). This is another ¼ turn maximum. • Tighten screws to approximately 35 inch pounds (3.95 Nm) • Torque bottom adjusting set screw to 6.5 inch pounds (0.73 Nm).
16.	Valve is now ready for reinstallation and placing into operational service.

Maxi-Maintenance Procedures

The following procedures should be followed for performing Maxi-Maintenance on the Model 11 Valve or the Model 11 Low Dead Volume Valve. Maxi-Maintenance procedures include the Mini-Maintenance procedures in addition to the disassembly, inspection and assembly of the valve plunger presented in this section. Refer to Figure 4-47.

Step	Procedure
1.	Perform the following Maintenance Procedures in the order presented: • Valve Cap Disassembly (Mini-Maintenance) • Cleaning Fittings and Tubing (Mini-Maintenance) • Valve Body Disassembly (Maxi-Maintenance) • Valve Body Assembly (Maxi-Maintenance) • Valve Cap Assembly (Mini-Maintenance)

Valve Body Disassembly

Step	Procedure
2.	Remove the six plungers (7) by inverting valve body (8) and then shaking it. Plungers should fall into the palm of hand. If a plunger(s) is stuck and does not fall out, delay removing it until after the spring loaded and air loaded pistons (14 and 11) are removed. The plungers can then be forced out from bottom of valve body.

CAUTION

When shaking plungers from valve body, do not allow them to fall on any abrasive surface. It is recommended that a lint free cloth, free of contaminants, be placed under the hand to protect plungers from damage.

3.	Examine plungers for damage. Any plunger showing defects, such as nicks, must be discarded and replaced with a new part.
4.	Remove air signal manifold (23) by removing the two screws (24&25) that secure it to the valve body (8). After manifold is detached, inspect the three o-rings (22) and replace if necessary. If the o-rings are undamaged, then set them aside (on a clean surface) for installation later.
5.	Use the plier tool supplied with the repair kit to remove the retaining ring clip (19).
6.	From bottom of valve body, remove retaining base (18), compression plate (17), compression spring (16) and compensation plate (15) from bottom of valve body (8). Refer to Figure 4-47.
7.	Use the plier tool supplied with the repair kit to remove spring-loaded piston (14) from valve body (8). Insert the tips of the plier nose into the holes in the underside of the piston and pull slowly.
8.	Remove air-loaded piston (11) from valve body (8)
9.	Using care to catch plungers (7), as presented in step 2, remove any stuck plunger using retaining ring pliers.

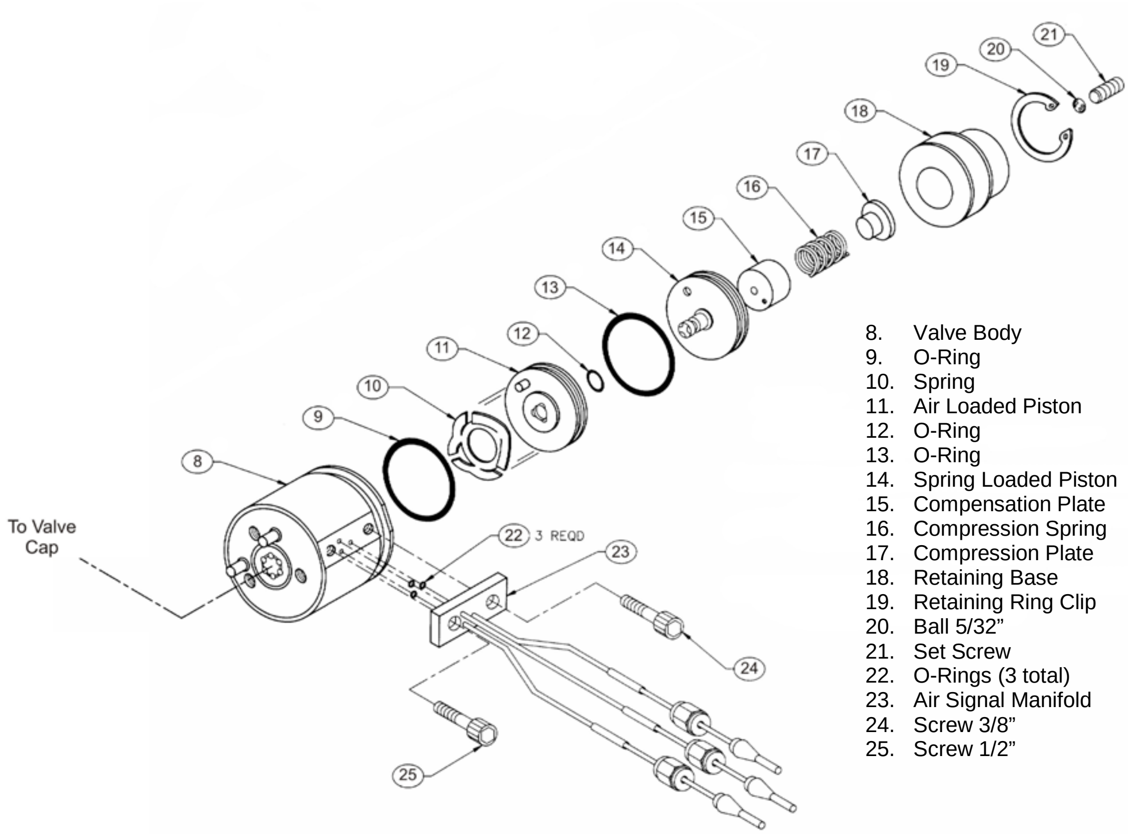


Figure 4-47: Valve Body Exploded View

Step	Procedure
10.	Examine plungers (7) for damage. Any plunger showing defects, such as nicks, must be discarded and replaced with a new part.
11.	Inspect interior of valve body (8), spring loaded piston (14) and air loaded piston (11) and silicon rubber "O" rings (13, 12 and 9) for contamination, odor or mechanical wear. Any part showing evidence of excessive wear or defects must be replaced with a new component. **DO NOT** reinstall any defective component.

Valve Body Cleaning

To clean the valve body after it has been disassembled, perform the following procedures.

Step	Procedure
12.	To clean the valve body, the following components are recommended: • Ultrasonic cleaner recommended • Cleaning solution such as strong detergent solution, hexane, acetone or methanol. Where indicated, use only Krytox Flourinated Grease (Siemens part number G87004). If a strong detergent solution is used, all cleaned parts must be thoroughly rinsed with a solvent to remove detergent residue before reassembling of valve body.

NOTE

If cleaning solvent becomes contaminated during performance of the following steps, replace it with a clean supply of cleaning solvent.

CAUTION ⚠

Do not place polished valve body (8), or associated parts, against any surface in ultrasonic cleaner or against any abrasive surface. Place parts on a lint free cloth, free of foreign contaminants.

Do not wash O-ring in any type of cleaning solvent.

13.	Fill Ultrasonic cleaner with cleaning solvent.
14.	Before placing valve body parts in Ultrasonic cleaner, wipe off all grease and foreign contaminants from valve parts.
15.	Place valve body parts on a lint free cloth in ultrasonic cleaner.
16.	Turn Ultrasonic cleaner ON and allow to run for 10 minutes.
17.	Remove parts and shake cleaning solvent from tubes. Let parts air dry before reassembling.

Valve Body Assembly

Step	Procedure
18.	Before reassembling valve body parts, clean hands, tools and perform reassembling procedures in a clean dust free area.
19.	Apply KRYTOX 240 AC in both "O" ring grooves of spring-loaded piston (14)
20.	Install silicon rubber O-rings (12 and 13) and apply KRYTOX 240 AC grease to their outer surfaces.
21.	Apply KRYTOX 240 AC grease to each of the fingers of the finger spring (10) of air-loaded piston (11).
22.	Place air loaded piston (11) over the small diameter of spring-loaded piston (14) with finger springs (10) outside. Align piston with guide pin. Refer to Figure 4-50.
23.	Apply a bead of KRYTOX 240 AC grease to the "O" ring air-loaded piston (11) groove. Refer to Figure 4-49.
24.	Install silicone "O" ring (9) and apply grease to the "O" ring outer surface.
25.	Apply a thin film of KRYTOX 240 AC grease to inside of valve body (8) where the pistons (14 and 11) will be sliding.
26.	Insert both pistons (14 and 11) into the bottom of cylinder. Use retaining ring pliers to install the pistons with the guide pin in the hole of the valve body (8). Refer to Figure 4-50.

CAUTION ⚠

Exercise care not to damage the O-rings when sliding them past the lower retaining ring groove.

27.	Apply KRYTOX 240 AC grease to the compression plate (17) beveled cone. Insert the ball (20) into the greased cone.
28.	Insert both the compression plate (17) and ball (20) into retaining base (18). Refer to figure 4-48.
29.	Apply KRYTOX 240 AC grease to base socket head set screw (21) then screw it into retaining base (18). Leave about one thread of set screw showing.
31.	Place compression spring (16) on compression plate (17).
32.	Place compensation plate (15) over the compression spring (16).

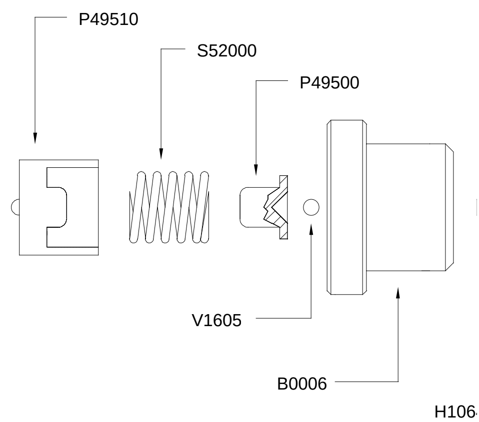


Figure 4-48: Assembly of Air Loaded and Spring Loaded Pistons

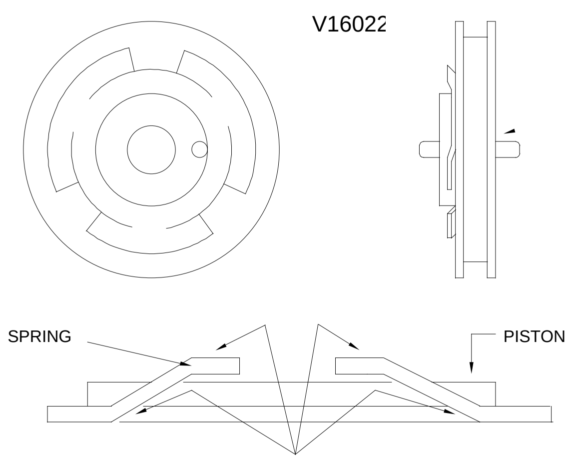


Figure 4-49: Greasing of Spring Pressure Points

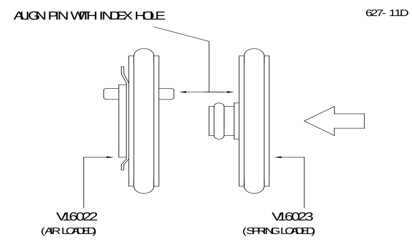


Figure 4-50: Valve Base Alignment Pin

Step	Procedure
33.	Before final assembly of components, apply a thin film of KRYTOX 240 AC grease to the outside of compensation plate (15) and inside of retaining base (18).
34.	Place the compression spring (16), compression plate (17); socket head set screw (21), retaining base (18) and compensation plate (15) into the valve body (8).
35.	Use the plier tool supplied with the repair kit to reinstall the retaining ring (19).

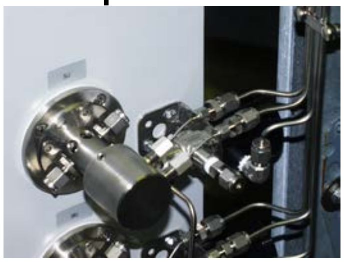
CAUTION ⚠

Be certain the retaining ring (19) sets into its mounting groove.

36.	Prepare to to install the manifold (23) by cleaning the flat surface on the side of the valve body (8) and then installing the three small O-rings (22) into the manifold (23).
37.	Align and install manifold (23) onto valve body (26) with two 8-32 screws (24 and 25). The shorter screw is installed in the top. Attach the manifold so that inlet holes on the manifold align with inlet holes on the valve body. Refer to Figure 4-47.
38.	If necessary, bend the top two manifold (23) tubes straight up ¼" from base of tube. Refer to Figure 4-46. Bend lower middle tube straight up ½" from manifold tube base.
39.	Reassemble valve cap (3) using the procedure provided earlier in this section.

Liquid Injection Valve

Description



This section provides routine maintenance and repair procedures for the liquid injection valve. A 6-week preventive maintenance schedule is recommended for servicing the valve; however, the schedule you choose will depend upon the:

- Sample properties
- Vaporization temperature
- Ambient temperature
- Sample pressure
- Analysis Duty Cycle

Valve Service Life

You can expect a 1 year service life for the valve. However, the service life of the valve is also dependent upon the properties of the sample as well as the preventive maintenance schedule. The service life of the valve is adversely effected if the sample is injected at a high sample pressure >20 bar (290 psi.).

Part Locations

Throughout this section, the numbers located next to part names, such as “Flange (17)”, refer to callouts listed in Figure 4-51. Refer back to Figure 4-51 for part locations.

Operational Notes

- If the sample has a corrosive effect on the surface of the injection stem (also called a tappet), the stem must be replaced with a different material type (e.g. Hastelloy).
- Over time, particles from the sample build up on the gaskets and will eventually obstruct the sample flow. Teflon and Rulon made gaskets are less subject to build up, but are not suitable for all applications. In addition, if the gaskets are subjected to temperatures outside of their rating they will loose their shape and reduce the service life of the valve.
- A sample that contains non-volatile or easily polymerized components (salts, proteins, monomers etc.) can deposit residues in the vaporizer (16), in the injection hole, on the sample flow unit (15), and on the injection stem (6). Therefore, these parts should be cleaned regularly if the sample contains materials which are not vaporized. Refer to Figure 4-51 for part locations.
- The sample flow unit (15) should be oriented vertically when the valve is installed. This is so that the sample will flow vertically through the valve to prevent air bubbles from forming in the valve. Make note of this when reinstalling the valve after service.

Liquid Injection Valve, Continued

Fault/Remedy Troubleshooting Chart

Fault	**Cause**	**Remedy**
All peaks appear smaller	Sample flow unit (15) or injection blocked. Buildup of material on injection stem.	Clean injection hole, stem (6), vaporizer (16) and sample flow unit (15). Replace gaskets (14) if necessary.
Peaks are becoming wide and shifted to longer times. Baseline becomes negative before injection of sample.	Vaporizer (16) is contaminated.	
Baseline becomes positive before injection of sample.	Gasket (14) between sample flow and vaporizer is leaking.	
Interruption in chromatogram: sample is not getting injected.	Leaky pneumatic actuator, grease used up, O-rings (4) damaged, control pressure too low.	Clean pneumatic actuator, replace O-rings, and grease sliding surfaces and O-rings.
Peaks too small and too wide, especially those with higher boiling points .	Heating plate is faulty. Vaporization temperature too low.	Replace heating plate. Set higher equalization temperature.
Injection quantity slowly rises until a double peak results (with calibration medium). Poor peak form, platform following peak. Increase in baseline. Visible discharge of sample.	Worn gaskets (14) and/or stem (6).	Replace gaskets (14) or stem (6).

Fault	Cause	Remedy
The section of the injection stem that is normally in the sample flow stream (near the notch) is rough. Material wear on this section of the stem is visible using a magnifying glass. The effect is significantly less on the rest of the stem.	Corrosive sample	Possibly replace injection stem (6) by version made of another material (e.g. Hastelloy)
Thin scratches are visible (with a magnifying glass) on the stem near the sample groove. These scratches run along the stem for several millimeters.	Sample is contaminated by particles (most frequent case). The particles get lodged in the gasket and scratch the stem during injection.	Check filter from sample system and replace if necessary. Replace stem (6) and gasket (14).
The space between the stem (6) and the inside wall of the vaporizer (16) is filled by deposits. This can block the supply of carrier gas. In extreme cases deposits may result on the stem (6).	The sample contains dissolved salts and other non-volatile materials.	The deposits in the vaporizer (16) may be removed mechanically (drill/reamer with 3.3 mm diameter), or the part may be replaced.
Brown deposits are present on the vaporizer gasket (14) at the outlet to the vaporization area.		

Maintenance Procedures

Figure 4-51 is an exploded view of the valve. Use this figure to aid you in removal and replacement of parts. Parts shown for the heater and sensor area may vary depending upon the valve type.

Removing Valve

Perform the following procedure to remove the valve from the oven. Removing the vaporizer (16) and flange (17) is optional when removing the valve.

WARNING ⚠

To prevent injury from burns always switch off the oven and valve heaters and allow the oven and liquid injection valve to cool down before touching the valve.

Step	Procedure
1.	Switch off oven and valve heaters and allow oven and valve to cool down.
2.	Switch off sample flow at the sample conditioning system and allow sample line to empty.
3.	Shut off power to the chromatograph.
4.	Shut off carrier gas and control air supplies.
5.	Unscrew the sample line and pneumatic actuation control lines from the liquid injection valve.

NOTE

Depending on the type of service being performed, it may not be necessary to remove the vaporizer and flange.

6.	(If removing entire valve) Disconnect the carrier gas inlet line from the carrier inlet tube (18), and disconnect the column from the vaporizer (16) outlet inside the oven and then remove the valve.
7.	(If not removing vaporizer and flange) Do not disconnect carrier gas or column. Unscrew the valve body (7) from the flange (17) and pull out.

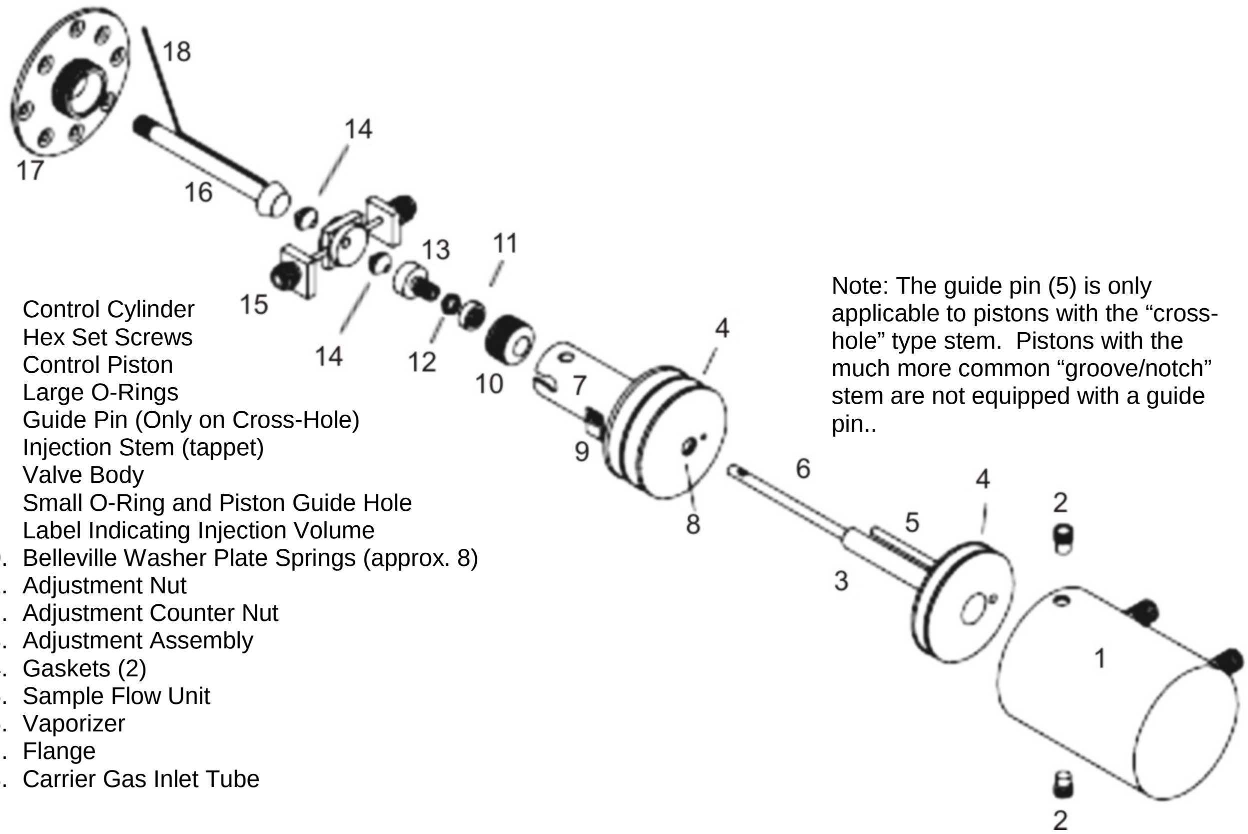
CAUTION ⚠

All work should be performed on a clean dry surface. Parts should be placed on a clean lint free cloth and hands should be clean.

Disassembling Valve

Refer to Figure 4-51 for the following procedure.

Step	Procedure
1.	If vaporizer (7)and flange (8) were not removed from the analyzer, then skip this step. Unscrew the valve body (7) from the flange (17) and vaporizer (16) and separate the components.
2.	Remove the 2 hex set screws (2) and remove the control cylinder (1).
3.	Lift off the sample flow unit (15) and adjustment assembly (13) from the injection stem (6).
4.	Remove the sample flow unit and the lens shaped gasket (if the gasket is not present it is stuck in the vaporizer) to allow the Belleville washer plate springs (10) to drop out.
5.	Pull the control piston (3) with stem (6) out of the valve body (7). Do NOT use any tools such as a screwdriver as a wedge between the piston and the valve body. This would damage the valve body and control piston.



1. Control Cylinder
2. Hex Set Screws
3. Control Piston
4. Large O-Rings
5. Guide Pin (Only on Cross-Hole)
6. Injection Stem (tappet)
7. Valve Body
8. Small O-Ring and Piston Guide Hole
9. Label Indicating Injection Volume
10. Belleville Washer Plate Springs (approx. 8)
11. Adjustment Nut
12. Adjustment Counter Nut
13. Adjustment Assembly
14. Gaskets (2)
15. Sample Flow Unit
16. Vaporizer
17. Flange
18. Carrier Gas Inlet Tube

Note: The guide pin (5) is only applicable to pistons with the “cross-hole” type stem. Pistons with the much more common “groove/notch” stem are not equipped with a guide pin..

Figure 4-51: Liquid Injection Valve Exploded View

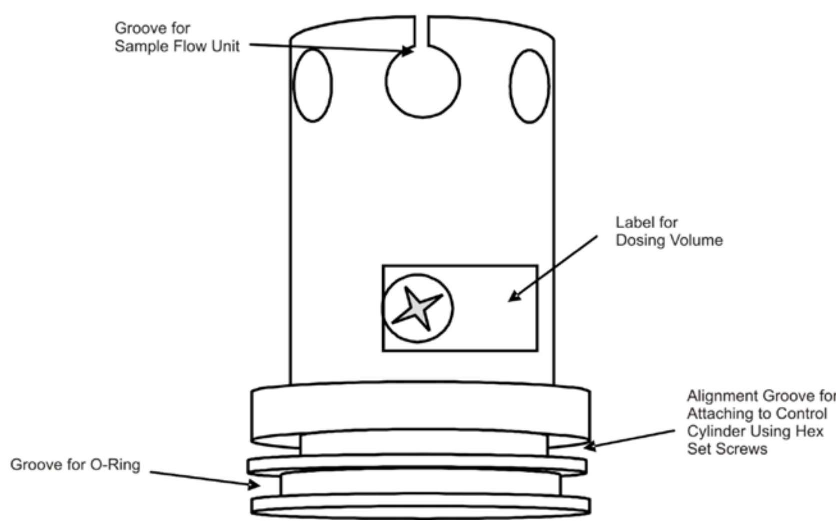


Figure 4-52: Liquid Injection Valve Body

Replacing the Teflon Gasket

Refer to Figure 4-51 for the following procedures.

Step	Procedure
1.	Replace the Teflon gaskets if they show any signs of wear or contamination.
2.	Remove the gaskets (14) from the adjustment assembly (13) and vaporizer (16). To do this, gently insert the tip of the stem (6) approx. 5 mm into the gasket and then tip to the side until the gasket is loose and can be pulled out with the stem.
3.	Insert new gaskets (14) into the adjustment assembly (13) and vaporizer (16). Use the correct type gasket according to the application and temperature class.
4.	There should be no play between the new gasket and the injection stem. It should be extremely difficult to move the gasket.

O-ring Replacement

Refer to Figure 4-51 for the following procedures. The silicone O-rings of the pneumatic drive should be regularly greased with Dow Corning Grease 111, 44 or equivalent.

Step	Procedure
1.	Carefully remove the two large O-rings (4) and the small O-ring (8) out of the valve body (7) and control piston (3) using a small screwdriver or a needle. Only use silicone O-rings, temperature class -40°C to +200°C.
2.	Insert new O-rings in all three locations (4 & 8).
3.	Liberally grease the new O-rings and the sliding surfaces of the control cylinder (1) and the piston guide (2 & 8). Siemens recommends using Dow Corning 111 with a temperature range from –40 to +260°C or Dow Corning 44 grease with a temperature range from –40 to +200°C

Valve Assembly

Read the following notes before performing the assembly procedure. Refer to Figure 4-51 for the following procedures

Notes

- The screw threads on the flange plate (17) must move freely. Grease if necessary.
- The diameter of the piston guide hole (8) should be 5.7 mm and be smooth. Replace the part if there are traces of wear on the piston shaft.
- The adjustment assembly (13) must slide smoothly down inside the valve body (7).

Procedures

Step	Procedure
1.	Before assembling the valve, apply a thin film of Dow Corning 44 grease to the following parts. Use Dow Corning 111 or 44 or any grease that has a temperature rating of –40 to +260°C • Internal wall of control cylinder (1) • Shaft of Control Piston (3) • Piston Guide hole/small O-ring (8) • Outside of Large O-rings (4)following reassembly of valve body (7) and piston (3)
2.	Insert the piston (3) with stem (6) into the valve body (7) such that the stem does not become greasy.
3.	Drop the Belleville washer plate springs next to one another over the stem into the valve body. Washers must be positioned in an alternating bevel up/bevel down manner (to form a spring). Refer to Figure 4-53 for washer orientation.
4.	Slide the adjustment assembly (13) with nut (11), counternut (12) and Teflon gasket (14) onto the stem.
5.	Insert the sample flow unit (15) into the valve body (7) over the stem (6). Refer to Figure 4-54. Note that the stem hole through the sample flow unit is tapered. This tapering is not readily apparent when looking at the uninstalled sample flow unit, but it will be visible when it is installed on the stem. The narrowest side of the hole in the valve body should face outward (toward the vaporizer). The narrowest side of the hole will be apparent because it will have the least spacing between the stem and the side of the hole. Refer to Figure 4-54. Newer sample flow units have this orientation marked with an arrow.

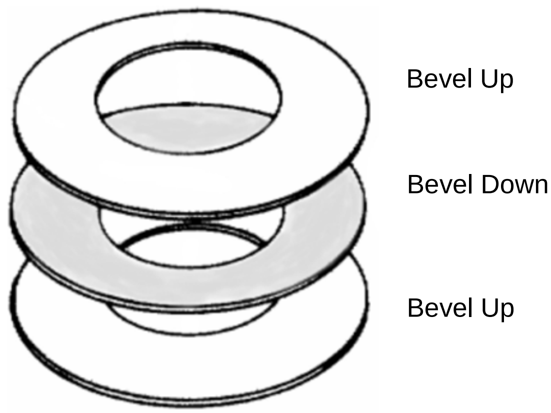


Figure 4-53: Belleville Washer Orientation

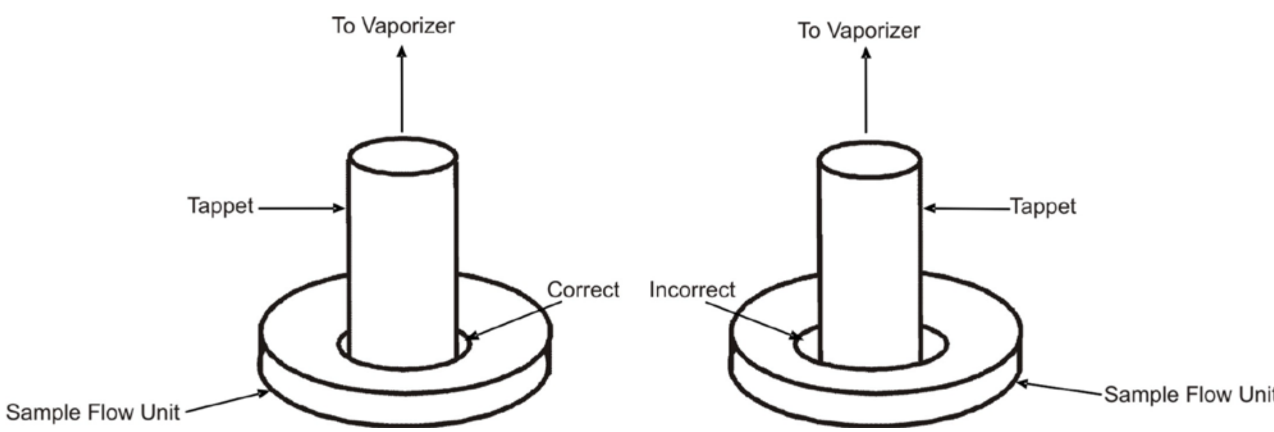


Figure 4-54: Orientation of Sample Flow Unit Hole

Step	Procedure
6.	Move stem (6) into filling position. This means that the stem should be “pushed in” towards the control cylinder (1)
7.	If you have completely removed the liquid injection valve, fit the flange (17) over the vaporizer (16), and screw the valve body (7) and the flange together.
8.	If the the flange plate (17) and vaporizer (16) were not removed from the analyzer, screw the partially reassembled valve onto the already installed flange plate.

Belleville Washer Spring Adjustment

It may be necessary to adjust the amount that the Belleville washer springs are being compressed. These washers should compress about 2 mm when adjusted appropriately. This compression distance is called “spring travel” and it is adjusted using the following procedure.

- Standard setting with 7 Belleville Washers: smooth round nut (11) extending about 0.5 mm past end of the threads on the adjustment assembly (13).
- Standard setting with 8 Belleville Washers; about 0.5 mm of threads showing below the round nut on the adjustment assembly (13). .

The spring travel is not critical, but more compression distance should be used for higher pressures (greater than 20 bars) and less should be used for low pressures (less than 2 bars). Adjust accordingly.

Step	Procedure
1.	Check the spring travel and correct using the adjustment assembly (13) if necessary. The spring travel is correctly set if the flange (17) can be rotated a further 2.5 rotations starting with the first pressing of the Belleville washer plate springs until the flange rests on the valve body. The plate springs can be viewed through a hole when pressing together. If the flange is tightened firmly, there should be a gap of 0.3 to 0.5 mm between the plate springs.
2.	If the adjustment is necessary, loosen the flange from the valve body again, and screw the nut and counternut in or out as necessary. Then repeat the preceding step.

Step	Procedure
3.	This step is only necessary if using the less common cross-hole stem and should only be executed if the entire valve including the vaporizer is removed from the analyzer. Rotate the vaporizer (16) using a 6mm wrench until the carrier gas inlet (18) is parallel to the sample flow unit (15). The carrier gas should flow through the hole in the stem when injecting.
4.	If the entire valve was completely removed from the analyzer (including the flange and vaporizer), reinstall it at this time, but do not connect control lines, sample lines, or carrier gas. When installing the valve, adjust the valve body (7) so that sample will flow vertically through the valve. This is necessary to prevent bubbles from forming in the valve.
5.	Position the control cylinder (1), and tighten the two hex set screws (2) on the side. The screws must firmly grip the groove in the valve body (5) wall. Refer to Figure 4-52.
6.	Connect the control lines.
7.	Activate the actuator pneumatically. Check that you can hear the switching and movement noises.
8.	Connect the sample lines. After connecting the sample lines inspect that they are not subjected to any strain and that sample will flow through the valve vertically (to prevent bubbles from collecting in the valve).
9.	Complete re-installation of valve into analyzer including reconnection of carrier gas and column tubing (if these were disconnected during removal).

Dosing Stem Replacement

Although it is possible to replace the control piston (3) and stem (6) without disassembling the valve body (7), Siemens recommends that the valve body be disassembled and serviced whenever the stem is replaced.

Temperature and Heating Components

To be supplied.

CAUTION

⚠

For Explosion Proof analyzers. If the heating assembly is removed, exchanged or retrofitted, the assembly must be tested and certified in accordance with appropriate regulations before the analyzer can be placed back in service.

Live Tee Switch

Description

Critical to the operation of the Live Tee Switch valve operation is the correct pressure and flow rates. This section provides procedures for setting the pressure and flow adjustments.

Procedure for Pressure and Flow Adjustments

To establish the operating pressures first ensure that the columns are not leaking and that the oven is at its operating temperature.

1. Shut off vent flows at the splitter/backflush vent, the cut vent and the purge vent.

2. Establish the desired forward column flow by adjusting the inlet pressure, then read and record the midpoint pressure at the live tee. This can be read directly from the EPC outputs.

3. Adjust the Pm (-) and Pm (+) EPC setpoint to a pressure slightly below the recorded midpoint pressure.

4. Re-establish flows at the vents, nominally 40 to 175 cc/min at the splitter vent, 10 to 70 cc/min at the cut vent and 10-30 cc/min at the purge vent. Optimum flow at the cut vent is approximately 5 times column flow. Flow instructions below 5 times column flow assume that the cut vent is connected to an ITC detector and that the purge vent is connected to the main detector downstream of the main column.

Notes Concerning Pressure and Flow Adjustments

When flows have been established at the cut vent and purge vent, the pressure at the midpoint is reduced, and flow through the pre-column increases. When the pressures at Pm(-) and Pm(+) are adjusted, flow in both columns is influenced, and peak retention times change slightly. It is better to start pressure adjustment of Pm(-) and Pm(+) at pressures slightly below the recorded midpoint pressure since the differential pressures required to operate the tee piece will be kept small and influence on the peak retention times will be minimized.

Cut On (Pa > Pm(-) > Pm(+))

The first adjustment is made in the cut on mode (Pa > Pm(-) > Pm(+)) by reducing the Pm (+) pressure by 20 mbar (0.3 psi) via adjustment of the Pm (+) EPC setpoint. Since two peaks can appear at the main detector from one component, one through the purge vent, and one through the main column, inject a single component test sample to prevent confusion resulting from multiple peaks. A third peak may also appear on the ITC from the cut vent if an ITC is used. A multiple component sample may easily lead to confusion of the identity of various peaks.

If two peaks appear at the main detector, the earlier eluting “pre-peak” has eluted through the purge vent at the retention time of the pre-column. If a third peak has also appeared at the ITC from the cut vent, first address the ITC peak by increasing pressure at Pm (+) (or decrease the pre column inlet pressure, Pa) by 0.1 psi increments until that peak disappears on subsequent injections. Then increase Pm (+) by 0.05 psi increments until the pre-peak just disappears. If no pre-peak appears at the main detector from the purge vent, further decrease Pm (+) in increments of 0.1 psi until a pre-peak appears at the main detector. Once a pre-peak is obtained, increase Pm (+) until it just disappears.

If no ITC is used, the Pm (-) pressure must be adjusted. Reduce the Pm (-) pressure (or increase the Pa pressure) by increments of 5 mbar or 0.1 psi until the main peak at the main detector is noticeably reduced in size, and then increase the Pm (-) pressure (or decrease the Pa pressure) until the size of the peak at the main detector is maximized. Reappearance of a pre-peak at the main detector will require additional adjustment of Pm (+).

Cut Off (Pa > Pm(-) <Pm(+))

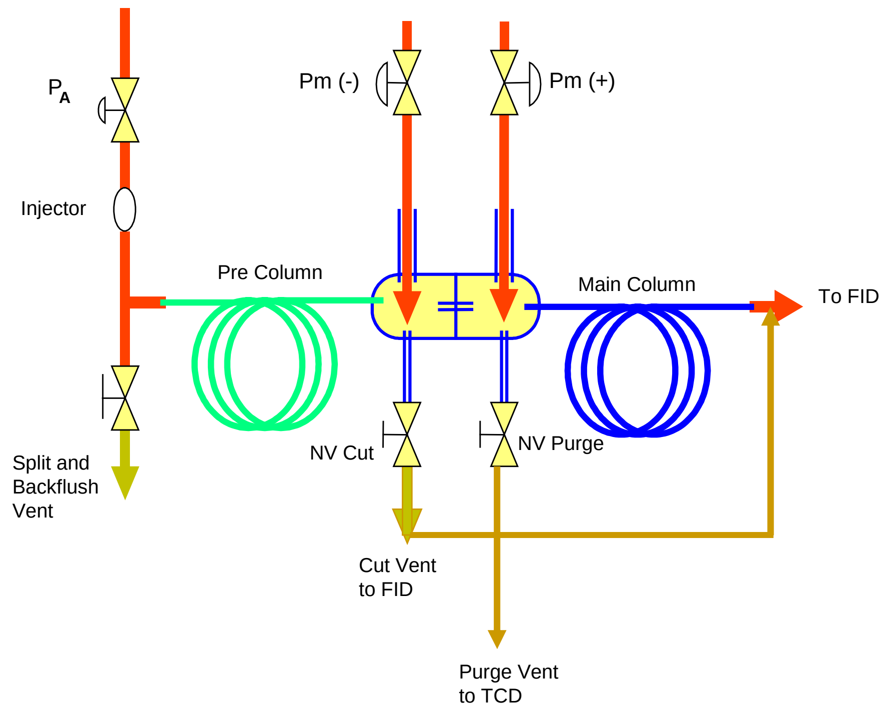
To adjust the live tee in the cut off mode of operation, reduce the Pm (-) pressure by 20 mbar (0.3 psi) and inject the test sample. If a peak appears at the main detector, the Pm (-) pressure must be further reduced until the peak at the main detector just disappears. If no peak appears at the main detector, incrementally increase the Pm (-) pressure until a peak appears, then incrementally reduce pressure until the peak just disappears.

Backflush On (Pa < Pm(-) < Pm(+))

To adjust the backflush on pressures, remove pressure from Pa and observe the backpressure at the Pa EPC output. Adjust the Pa EPC pressure to a pressure 0.5 to 1.0 psi higher than the backpressure observed in order to insure that there is a positive purge of carrier gas through the sample valve and carrier inlet to prevent backflush flow from contaminating the carrier inlet system.

Description

The following is an example of an actual application using the live tee. Actual flows and pressures are indicated and chromatograms are provided to illustrate the set up process.



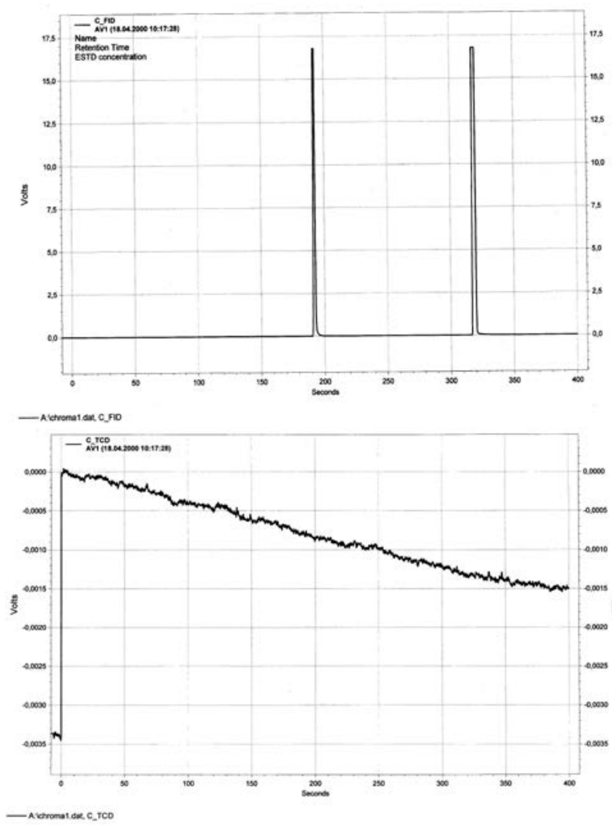
Switching Configuration:	Split Vapor Injection
	Backflush To Vent With Heartcut (Cut Vent Flow To FID) Purge Flow to ITC (TCD)
Pre Column:	50 m, 0.32 mm id, 1.2 um, Carbowax FSOT
Main Column:	50 m, 0.32 mm id, 5 um, ALOX Na2SO4 FSOT
Oven Temperature:	100°C
Carrier Gas:	Nitrogen

Pa	EPC 2-1	Carrier Inlet
Pm(-)	EPC 3-1	T-Piece Inlet (end of A- or Pre Column)
Pm(+)	EPC 3-2	T-Piece Outlet (Inlet of B- or Main Column)

Operation Checks and Evaluations

1. Columns are installed and leak checked.
2. Based on column length, diameter, carrier gas and oven temperature, Pa was set to 38.2 psi, approximately 3.5 cc/min.
3. In order to determine the midpoint pressure, the split vent and tee piece vents were capped off and Pm (-) and Pm (+) EPCs were turned off.
4. The oven was stabilized at operating temperature of 100°C.
5. A midpoint pressure Pm of 24.8 psi was recorded at Pm (-) and Pm (+) by directly reading the Pm (-) and Pm (+) EPC outputs.
6. All vents were opened and reconnected.
7. Oven temperature was allowed to stabilize.
8. Flows were adjusted as follows:
   - Splitter: 60 cc/min.
   - Cut Vent: 25 cc/min.
   - Purge Vent: 10 cc/min.
9. Open Fuel Gas and Combustion air and ignite the FID.
10. Adjust EPC pressures as follows:
    - Pa 38.2 psi
    - Pm (-) 22.8 psi
    - Pm (+) 22.8 psi
11. Inject 100% methane as a single component test sample to perform the fine adjustment of the midpoint pressures. Use of a single component sample will eliminate confusion resulting from multiple peaks.

12. Chromatogram 1: Pa=38.2 psi, Pm(-)=22.8 psi, Pm(+)=22.8 psi



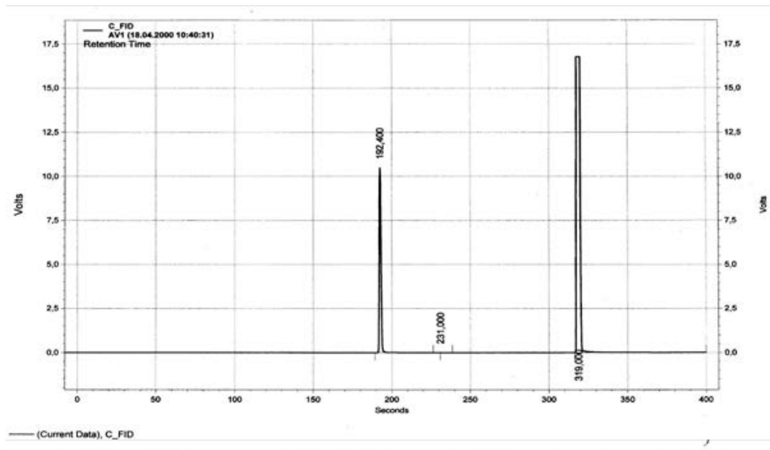
FID: Peak 192 seconds ➔ from cut vent
TCD: No peak ➔ from purge vent

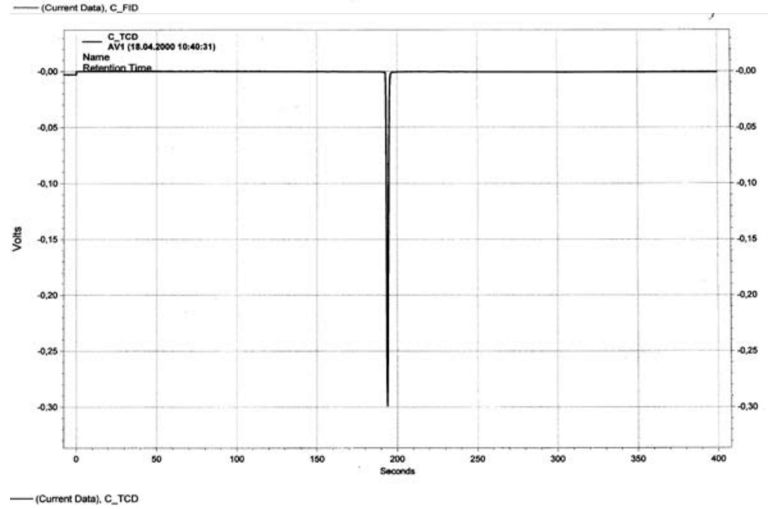
Peak 318 seconds ➔ from 2^{nd} col.
Average linear velocity through main column: 32 cm/sec.
Average linear velocity through pre-column: 26 cm/sec

Typically for equal column lengths, the ratio of pre-column to main column linear velocity will be 2:3 (20 cm/sec. to 30 cm/sec.). In this case, since the PLOT column has a higher resistance to flow than the FSOT, the ratio is higher. This ratio can vary widely with the ratios of column lengths used.

Since the pressure at the pre-column outlet is slightly higher than the Pm (-) pressure, a small component of pre-column flow is swept out the cut vent and a pre-peak shows on the chromatogram at 192 seconds. The Pm (+) pressure is slightly higher than the pressure at the inlet of the main column, so all flow through the tee piece capillary enters the main column and there is no peak at the purge vent ITC.

13. Chromatogram 2: Pm (-) adjusted to 22.9 psi, $\Delta P = +6.9$ mBar

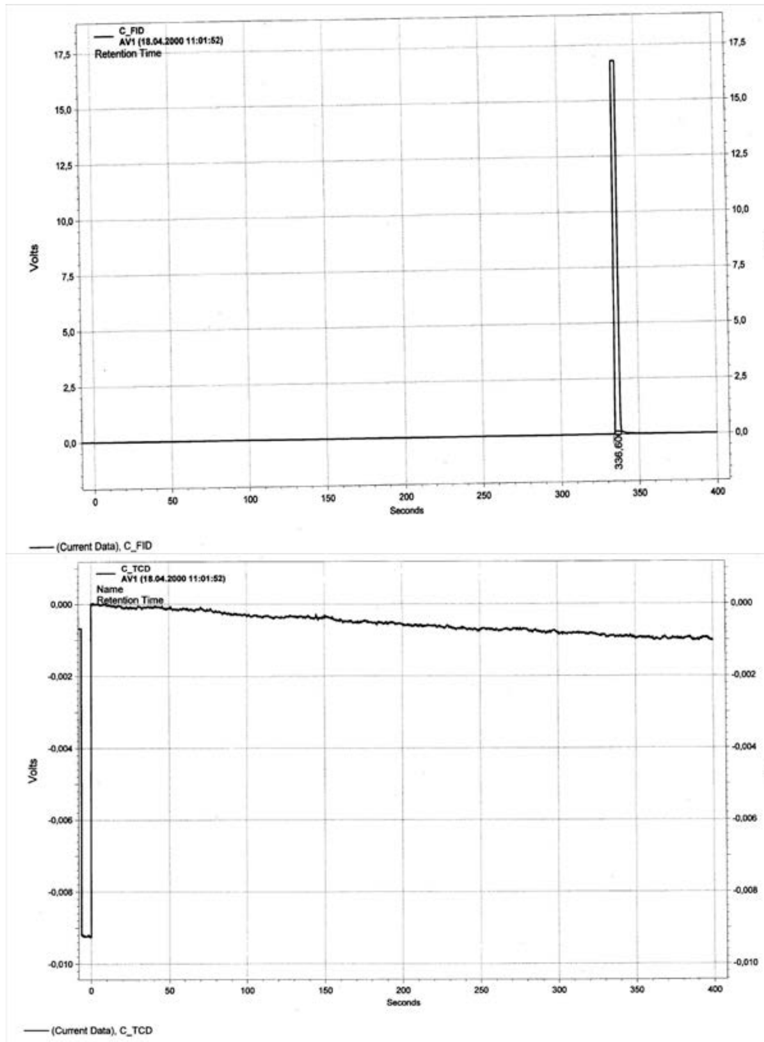




FID: Peak 192 seconds ➔ from cut vent
TCD: Peak 192 sec. ➔ from purge vent
Peak 319 seconds ➔ from 2^{nd} col.

Pressure at the pre-column outlet is still slightly higher than the Pm (-) pressure so there is still a peak at 192 seconds on the FID but now pressure at the main column inlet is slightly higher than the Pm (+) pressure, and some carrier flows out the purge vent causing a peak on the ITC at 192 seconds (a negative peak due to nitrogen carrier gas).

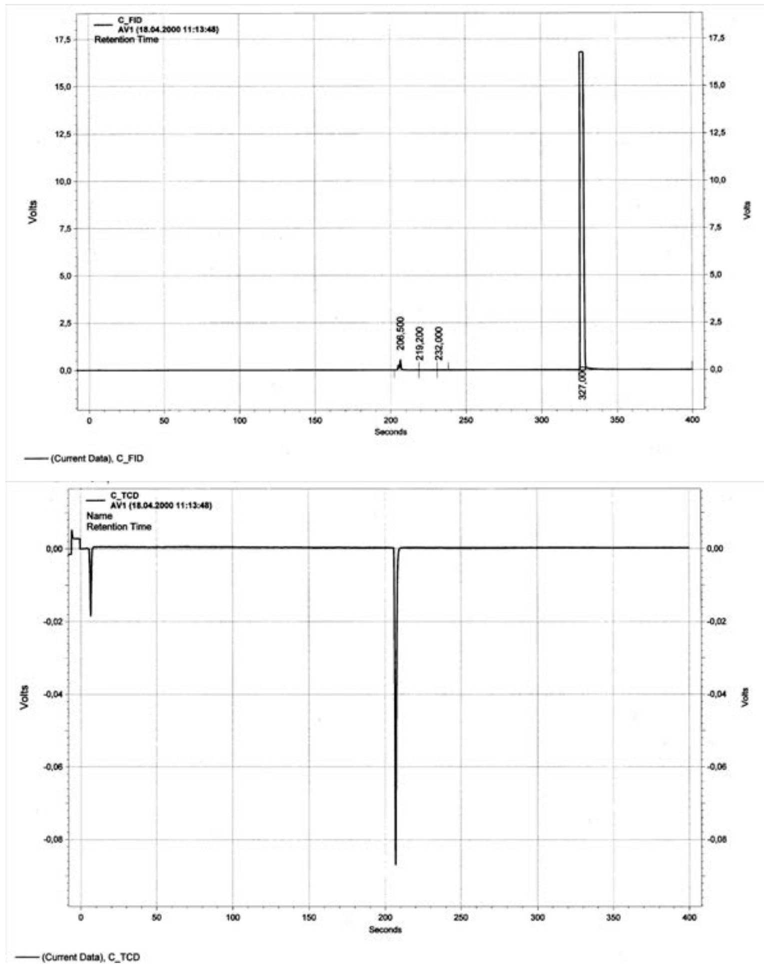
14. Chromatogram 3: Pa=38.2 / Pm (-)=24.9 / Pm (+)=24.8 psi ΔP = +6.9 mBar



FID: Peak 336 seconds ➔ from 2nd col.
TCD: No peak

Both Pm pressures have been increased in a large step change. Pm (-) is now higher than the pressure at the outlet of the pre-column, and Pm (+) is now higher than the inlet of the main column, so only one peak shows up, on the FID at 336 seconds. The increase in retention time is due to the decrease in linear velocity in the pre-column due to the increase in its outlet pressure (Pm (-)).

15. Chromatogram 4: Pa=38.2 / Pm (-)=23.9 / Pm (+)=23.8 psi   ΔP = +6.9 mBar



FID: Peak 206 seconds ➔from cut vent
TCD: Peak 208 sec. ➔ from bypass vent
        Peak 327 seconds ➔from 2nd col.

There is a small peak coming from the heart cut vent that indicates that almost all flow from the pre-column enters the transfer capillary. The pressures there are very nearly balanced. There is still flow from the tee piece capillary entering the purge vent, indicating Pm (+) is still slightly low.

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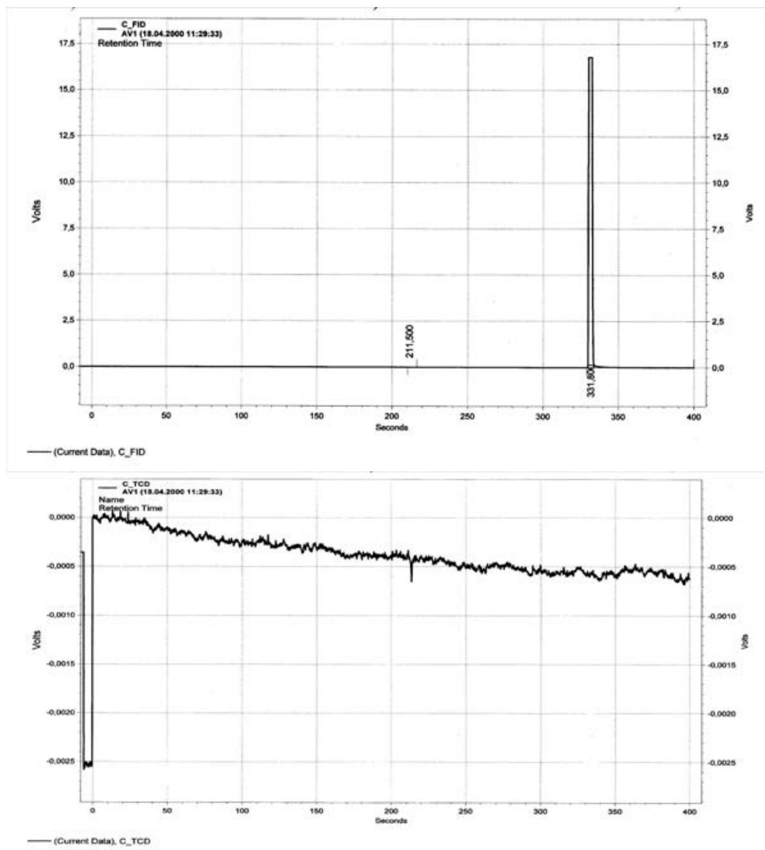
16. Chromatogram 5: Pa=38.2 / Pm (-)=24.4 / Pm (+)=24.3 psi ∆P = +6.9 mBar

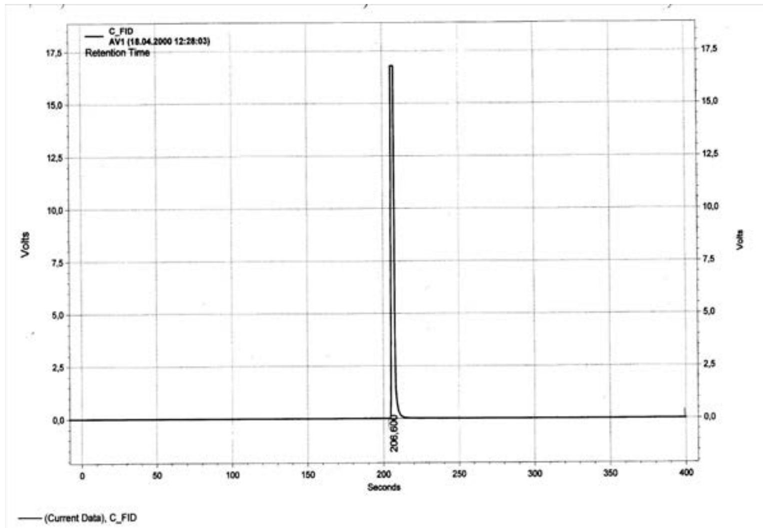


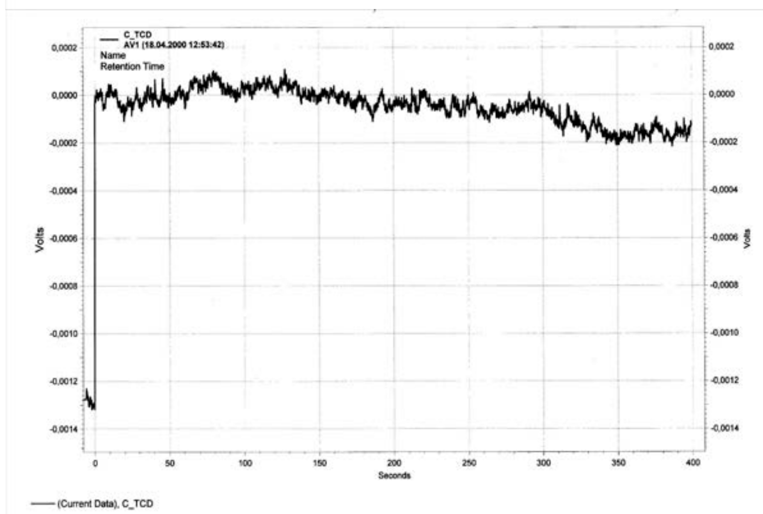
FID: Peak 211.5 sec. ➔ from cut vent
TCD: Peak 204 sec. ➔ from bypass vent
Peak 331 seconds ➔ from 2nd col.

There is a very small peak coming from the cut vent that indicates that virtually all flow from the pre column enters the transfer capillary. There is a very small peak coming from the purge vent that indicates that virtually all flow from the tee-piece transfer capillary enters the main column.

These are the threshold settings under these conditions for the **Straight or Cut On** settings. To ensure perfect conditions even when injecting a high concentration of a fast-eluting, tall peak, the parameters are set to **Pa=38.2 / Pm (-)=24.5 / Pm (+)=24.42 psi, ∆P = +5.5 mBar.**

17. Chromatogram 6: Pa=38.2 / Pm (-)=23.5 / Pm (+)=24.42 psi ΔP = -63 mBar

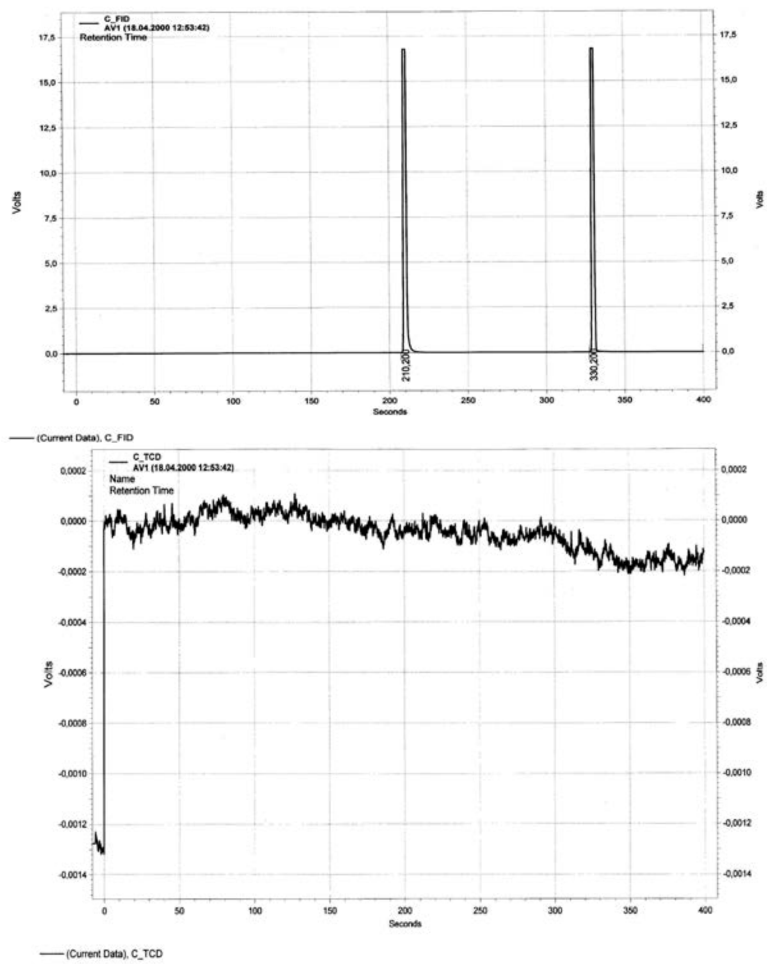




FID: Peak 206.6 sec.➔from cut vent
TCD: No peak

There is no peak on the bypass vent or after the second column. Therefore, all flow from the first column is vented through the cut vent. The pressure of Pm (-) is low enough to prevent any pre-column flow from entering the main column. However, since retention times change with the pressures applied, the differential pressures must be kept as low as practical to minimize the influence on retention times.

18. Chromatogram 7: Pa=38.2 / Pm (-)=24.0 / Pm (+)=24.42 psi ΔP = -30 mBar



FID: Peak at 210.2 sec. ➔ from cut vent
TCD: No peak
Peak at 330.2 sec. ➔ from 2nd col.

There is a peak coming from the main column. Therefore, there is some flow from the pre-column transferred through the tee-piece to the main column. Consequently, the slightly pressure of Pm (-) is not sufficiently low to ensure that all pre-column flow is vented. Therefore, the previous setting of **Pm (-) at 23.5 psi** for the **Cut Off** position is accepted.

19. In order to determine the backflush Pa settings, adjust;

    - EPC 2-1 (P_a) to 0 psi
    - EPC 3-1 (P_m -) to 23.5 psi
    - EPC 3-2 (P_m +) to 24.42 psi

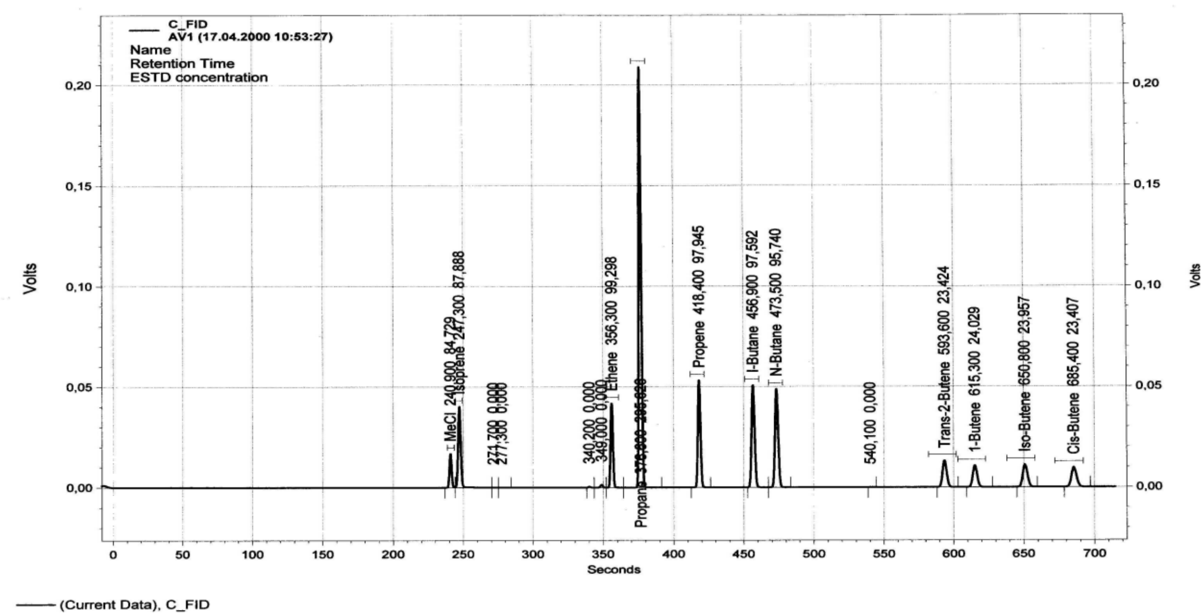
    The EPC 2-1 output settles at 1.5 psi. Consequently, in order to prevent any backflush components from contaminating the injection valve and the carrier gas supply, the backflush pressure P_a is set to **2.0 psi** for **Backflush On.**

Parameter Summary:

Pre Column: 50 m, 0.32 mm id, 1.2 um, Carbowax FSOT
Main Column: 50 m, 0.32 mm id, 5 um, ALOX Na2SO4 FSOT
Oven Temp: 100°C
Carrier Gas: Nitrogen
Split Vent: 60 cc/min.
Cut Vent: 25 cc/min.
Bypass Vent: 10 cc/min.

EPC 2-1, Pa	Backflush Off: 36.2 psi	Backflush On: 2.0 psi
EPC 3-1, Pm(-)	Cut Off: 23.5 psi	Cut On: 24.5 psi
EPC 3-2, Pm(+)	Cut Off: 24.42 psi	Cut On: 24.42 psi

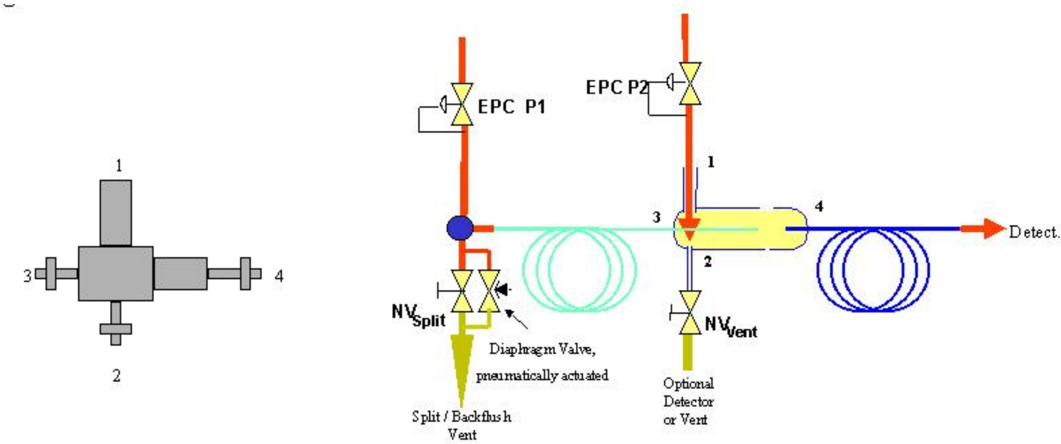
The following chromatogram shows the result for this application using a process sample. The group Ethylene to cis-2-butene is transferred from the pre-column to the main column (Straight). After elution of cis-2-butene from the pre-column, MeCl and Isoprene are diverted to the detector via the cut vent (Cut Off). After Isoprene has eluted from the pre-column, the backflush is triggered (Backflush On).



Live Tee Example Application, Continued

The Back - T:

A special case of the Live-T is the Back-T, a valveless column-switching device that incorporates only the backflush function of the Live-T. Figure 4-55 is a schematic representation of the Back-T. In this device, there is no capillary tube at the junction of the two columns; rather a small make-up flow is added at the column junction within the Back-T by operating EPC-2 at a slightly higher setpoint than the observed midpoint pressure. In Figure 4-55, the diaphragm valve at the splitter vent is optional, and the purge vent flow from the Back-T can be routed to the main detector as a make-up flow, to vent, or to a second detector.



1 EPC 2	Carrier In	1/16" Tubing	7 mm Thread
2 Vent	Carrier Out	Capillary / < 1 mm Tubing	5 mm Thread
3 Pre Column Inlet		Capillary /< 1 mm Tubing	5 mm Thread
4 Main Column Inlet		Capillary /< 1 mm Tubing	5 mm Thread

Figure 4-55: Back-T Configuration for Backflush

Operation and flow adjustment of the Back-T is identical to that of the backflush function of the Live-T. To summarize, first the split and purge vents are disconnected and capped and EPC-2 is disabled. EPC-1, P1 is adjusted to the pressure necessary to yield the desired column flow at the main detector. The mid-point pressure for the column system is observed at EPC-2. EPC-2 is then enabled and its setpoint adjusted to 0.2 to 0.3 psi higher than the observed mid-point pressure. The splitter and purge vents are then reconnected; the purge vent flow is adjusted to 15 to 25 cc/minute and the split vent adjusted as necessary. To operate in the backflush mode, switch EPC-2 to P2 and operate P2 at about 3.5 psi to maintain a small flow sweeping through the inlet system. For detailed treatment, refer to the appropriate section of the Live-T instructions.

Flame Photometric Detector

Description

This section provides preventive maintenance and repair procedures for the original flame photometric detector (FPD), and the redesigned flame photometric detector (FPD II). Troubleshooting charts are provided should the detector fail to operate. The troubleshooting charts are applicable to both the FPD and the FPD II.

FPD parts should be removed or replaced only by a trained Siemens maintenance engineer or by the user's maintenance personnel trained by Siemens.

Before You Begin

The photo multiplier in the FPD is sensitive to light. Avoid any unnecessary influence of light on the multiplier, even in the voltage-free condition. Never subject the light entry window to a bright light source.

- Shut down the FPD
- Switch off chromatograph

Shut-down Procedure

- Shut off the detector Hydrogen
- Allow the detector to cool down.
- If the detector is to be shut down for a longer period, shut off detector air and cover the detector vent.
- Never disconnect the fiber optic cable (from either end) while the power is applied to the PMT module.

Preventive Maintenance

The detector baseline noise and balance level should be noted when the analyzer is first installed and then checked on a periodic basis.

Using a workstation, the baseline noise can be noted manually by zooming in and observing the baseline on a chromatogram. One can also observe the digital signal of the detector on the Maintenance Panel on the "detector" screen. To be effective, the scan rate for the detector AI must be set to 1 second.

If the analyzer has software release 4.2 or higher the noise can be measured automatically by setting up a measurement RMS (root mean square) noise measurement in the "smoothing" module in EZChrom. The measurement can be output as a "result" and handled as any component result is handled.

Quartz Tube Handling and Cleaning

The quartz tube requires special handling procedures and special cleaning processes. Do not touch the tube with your hands or any metal object. Plastic tweezers are preferred. Dustless rubber or low lint gloves may be used to handle the tube. When the tube is replaced, replace the o-rings at the same time.

The tube is properly cleaned before shipment. If cleaning becomes necessary, cleaning of the quartz tube should be performed either by Siemens or within a properly equipped lab environment by trained personnel. For lab purposes, the recommended cleaning method is placing the tube in an equal-part mixture of H2O (deionized), HCl, and HNO_3 in an ultrasonic cleaner for 30 minutes. The tube should be rinsed in deionized water and air dried. Caution should be used handling the tube after it is cleaned to prevent contamination.

Flame Detection

The best way to tell if the flame is lit is to use the program supplied with the analyzer. The next best way to tell if the flame is lit is to observe the detector baseline. If the detector is lit the baseline will have a noise level of 100µV or higher. If it not lit the noise will be on the order of 10µV with occasional single spikes of 20-30µV. Also, the noise is at a higher frequency when the flame is not lit than when it is lit. The detector balance signal will be higher with the flame lit than with it off.

An alternative visual test can be used to determine if a flame is not lit. The flame produces water vapor which can be seen on a mirror held up to the detector vent. If there is no water vapor coming from the vent, the flame is not lit. However, water vapor may at times come from the vent when the flame is not lit (because of a condition where water is produced catalytically on the glow plug). Therefore, this test can only be used to verify if the detector flame is NOT lit.

Installation: Replacing Original FPD with FPD II

Instructions for replacing an existing FPD with an FPD II in a Maxum II are included in the Maxum II Extended Service Manual.

Troubleshooting Charts

The following troubleshooting charts should be used in the event of an FPD failure

Observation: FPD is cold:

Cause	Remedy
Heater is turned off.	Switch on the heater.
Heater or temperature sensor not connected correctly.	Connect the cables correctly.
Fuse, heating cartridge, Pt100 or heater control element faulty.	Replace faulty part.

Observation: Flame Does not Ignite

Cause	Remedy
Combustion gas and combustion air connections are reversed.	Connect correctly. Correct leaks if necessary.
Air flow rate not sufficient.	Temporarily increase air pressure to 2-3 times normal pressure during the ignition process.
Glow plug faulty	If the glow plug is faulty the amber light will not light when an attempt is made to light the flame. Check the wiring connections then replace the glow plug

Observation: Detector Balance Level is Too High

Cause	Remedy
Light enters the detector.	Check connections on light pipe.
Detector temperature is too high.	Set lower detector temperature.
Contaminated combustion or carrier gas.	Use high purity hydrogen and breathing quality air - replace cylinders.
Faulty light pipe (rarely defective)	Replace light pipe.

Observation: High Detector Noise with Flame Off

Cause	Remedy
Bad electronic connection	Check wiring and connections
Electronic failure	PMT module and DPM are suspect Change each one at a time to determine cause. Note: Replace DPM first as PMT modules are rarely defective.

Observation: High Detector Noise with Flame On

Cause	Remedy
Contaminated gas	Change cylinder
Leak	Perform a leak test on the system
Gas flow rates are incorrect	Check gas flows and correct

Observation: No Peaks on Chromatogram

Cause	Remedy
Gas flow rates are incorrect	Check gas flows and correct
Sample valve not working correctly	Repair/replace sample valve
Flame not lit	See below*
No sample flow	Check analyzer flow rotometer
Other Causes	Refer to low sensitivity section

Observation: Sensitivity is Too Low

Cause	Remedy
Sample incorrect	Check with calibration blend
Sample flow too low	Check analyzer flow rotometer
Contaminated sample lines	Check with calibration sample connected with clean tubing to sample valve
Calibration sample incorrect	Check with new blend or have blend checked on another analyzer or lab
Leak	Perform a leak test on the system
Combustion gas flows incorrect	Check and correct flows
Hydrocarbon co-eluting with sulfur peak	Check chromatograms for deviations from normal. Have sample checked in lab for unusual components
Columns degraded or contaminated	Replace columns with new set
Integration parameters incorrect	Correct EZChrom method
Wrong method loaded	Load the correct method
Temperature of detector too low	Correct cause of low temperature
Contaminated quartz tube	Replace tube (refer to special handling instructions for quartz tube listed earlier in this section).

Flame Ionization Detector (FID)

Description

This section provides preventive maintenance and repair procedures for the Flame Ionization Detector (FID). Troubleshooting charts are provided should the detector fail to operate.

FID parts should be removed or replaced only by a trained Siemens maintenance engineer or by the user's maintenance personnel trained by Siemens.

Shut-down Procedure

1. Shut off the detector Hydrogen and allow the detector to cool down. Carrier gas should remain on during cool down to prevent condensation.
2. Turn off all supply gasses.
3. Power off the analyzer
4. If the FID is shut down for an extended period of time, the exhaust gas nozzle should be sealed to prevent dust contamination.

Cleaning Procedures

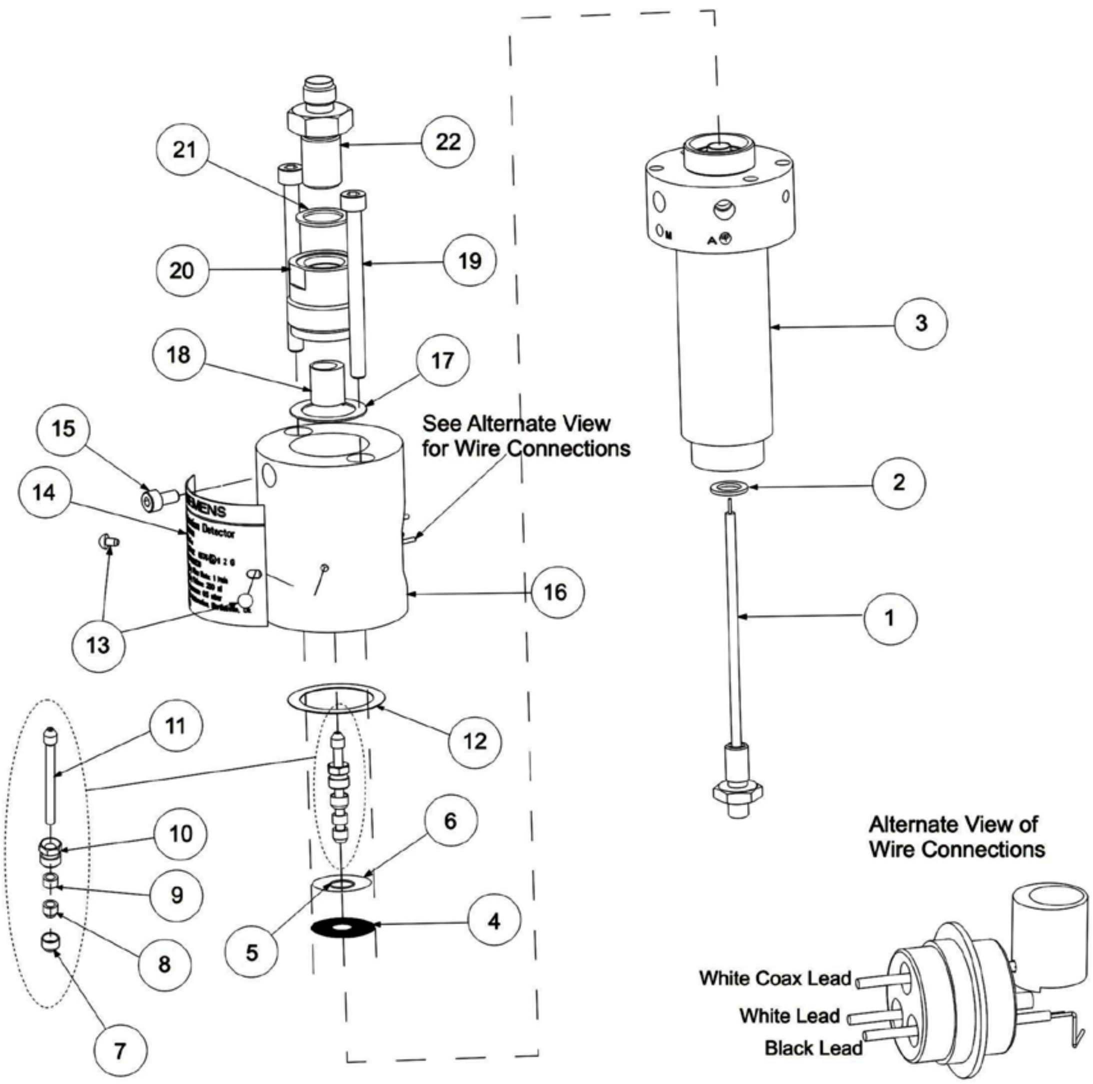
The following cleaning procedures can be performed without removing the FID from the oven. Refer to Figure 4-56 for all procedures. However, a clean work surface is necessary for maintenance of detector parts.

Danger ⚠

Never open the Ex-FID in explosive areas with the flame burning or with the power on!

Clean/Replace Flame Arrestor Insert Assembly

1. Shut down as described above.
2. Loosen and remove the Flame Arrestor Insert Assembly (1) from the FID Bottom Body (3) using a 9/16 inch open-end wrench.
3. If Flame Arrestor Insert Assembly is clogged, it may be possible to clean it using solvent and a syringe. However, replacement is recommended. If attempting to clean the assembly, blow out any excess solvent using carrier gas.
4. When cleaning/replacing Flame Arrestor Insert, it is necessary to replace the Flat Washer (2). Because this washer is made of soft aluminum, it should not be reused.
5. Place the Flame Arrestor Insert (1) and the new Flat Washer (2) in the Bottom Body (3) and tighten using a 9/16" open-end wrench. Make sure that the Flat Washer fits into the recessed cavity at the lower end of the Bottom Body (otherwise leaks may result).



1. Flame Arrestor Insert Assembly
2. Flat Washer
3. Detector Body (Bottom)
4. Filter
5. Retainer - Small
6. Retainer - Large
7. Outer Ferrule
8. Graphite Ferrule
9. Pressure Ferrule
10. Burner Nut
11. Quartz Jet (with flame tip nozzle)
12. Graphite Seal
13. Hammer Drive Screws (for Label)
14. Label
15. Socket Heat Cap Screw
16. Detector Body (Upper)
17. Teflon Seal
18. Collector
19. Socket Heat Cap Screw (M5 x 60)
20. Flame Arrestor Bushing
21. Flat Washer
22. Flame Arrestor

Figure 4-56: FID Assembly

Clean/Replace Quartz Jet Nozzle (11)

In the unlikely event that the Quartz Jet (11) becomes dirty or clogged, instructions for replacing the Quartz Jet and associated hardware (7, 8, 9, 10, and 11) are included in the Maxum II Extended Service Manual.

Replacing/Cleaining of Mesh Filter (4)

Because of the very small diameter of the Combustion Air Restrictors, it is unlikely that the Filter (4) will become dirty or clogged. Because it is difficult to remove this filter without damaging it, if the filter is ever removed during rebuilding/cleaning of the valve, it should be replaced and not reused. Instructions for replacing the Mesh Filter are included in the Maxum II Extended Service Manual.

Clean/Replace the Flame Arrestor Hardware (20, 21, and 22)

1. On the side of the FID loosen the mounting screw (15), which is used to secure the Flame Arrestor (22).
2. Unscrew/Remove the Flame Arrestor (22), Flat Washer (21) and Bushing (20).
   Note: Earlier versions of the FID are equipped with a single piece Flame Arrestor (referred to as a “rattler” because it rattles when shaken). This Flame Arrestor can be replaced with the newer Arrestor/Washer/Bushing combination with no additional hardware.
3. It may be possible to clean the Flame Arrestor with a solvent. However, replacement it recommended. If attempting to clean using solvent, allow all solvent to dry before reinstalling.
4. Reinstall the Flame Arrestor (20, 21, and 22) and secure using the mounting screw (15) on the side of the FID.

Replace Gas Restrictor Connectors

If Combustion Gas or Combustion Air restrictors become clogged, replacement is recommended as the crimps and coils on the restrictors will prevent effective cleaning. Unscrew and replace the restrictor using the appropriate open-ended wrench.

Caution ⚠

Install only the prescribed gas connectors with pressure reducers in the Ex-FID, otherwise the ex-protection becomes invalid.

Checking/Replacing Coaxial Cable

If the coaxial cable is bent or crushed or if the connectors are damaged or defective, the cable must be replaced. Care should used when replacing the cable so as not to damage the insulation around the electrode connector.

Cleaning Upper Body (16) and Electrodes

Cleaning of the electrodes is NOT recommended. Do NOT use solvent on the electrodes. However, separations involving silicon may lead to buildup of silica (white powder) in the body. This can cause reduced flow and loss of sensitivity. In this instance it is possible to brush off the silica using a glass brush.

Igniter Replacement

A few very sporadic issues (refer to the troubleshooting charts in this section) have been observed in association with autoignition of the FID. A redesigned FID igniter board, has been developed to address these issues. If you are experiencing issues with the igniter, contact Siemens regarding the possibility of upgrading to the new igniter. If experiencing issues with the igniter, avoid using auto-ignition until igniter is replaced.

All future igniter replacements will utilize the new version of the igniter. Detailed procedures for upgrading the FID igniter are included in the Maxum II Extended Service Manual.

Troubleshooting Charts

The following troubleshooting charts should be used in the event of an FID failure.

Observation	Cause	Correction
Flame does not ignite.	Combustion gas flow rates are wrong.	Adjust correct gas flow rates.
	Combustion gas flow low because restrictors are clogged by small dirt particles.	Clean or replace restrictors.
	Combustion gas filter (4) clogged.	Clean or replace filter.
	Combustion gas and combustion air connectors are reversed.	Connect H_2 to combustion gas connector.
	Ignition spark does not jump from ignition electrode to quartz jet.	Check insulation of the ignition line (also in the ignition module).
	Flame arrestor (22) clogged by deposits.	Clean or replace flame arrestor (22).
	Quartz jet (11) is defective or improperly installed	Replace or reinstall the quartz jet (11).
Base line drifts at stable temperatures.	Less drift without carrier gas?	
	Yes: Column or carrier gas is contaminated.	Replace column or switch carrier gas bottle.
	No: Contamination in quartz jet (11) and/or in the bottom detector body (3)	Heat detector overnight at the maximum allowable temperature.
	Low supply gas pressure.	Immediately change bottle.

Observation	Cause	Correction
Baseline current is too high.	Contamination of: - supply gases	Filter supply gas.
	- lines	Clean gas supply lines.
	- detector: signal even without flame.	Disassemble and clean detector.
	Combustion gas flow is too high.	Optimize flow.
	Column contaminated This can be verified by checking baseline current without column attached. If the baseline current is ok without the column connected, then the column is contaminated. Note – this check will not work if using hydrogen carrier.	Replace column. Heat detector over night at 160 to 180°C.
Baseline is noisy. If noise is gone when measurement cable is unplugged from the DPM, then either the detector or measurement cable is faulty.	Detector is faulty if noise is gone without flame.	Disassemble and clean detector.
	Measurement cable is faulty if noise exists even without flame.	Properly insulate and connect measurement cable/replace measurement cable.

Observation	**Cause**	**Correction**
Baseline raised to 4-5 Volts (signal completely dead)	Possible problems with old FID igniter.	Contact Siemens regarding whether it is necessary to replace the igniter.
RTD Failure alarms on the temperature control circuits (in the PECM or DPM).	Possible problems with old FID igniter. May cause affected module to fail.	Contact Siemens regarding whether it is necessary to replace the igniter. Replace affected module if it is faulty.
I^2C failure issues after FID auto-ignition.	Possible problems with old FID igniter.	Contact Siemens regarding whether it is necessary to replace the igniter.
Measurement sensitivity is too low.	Leaks before and after separation column.	Find and correct leak.
	Quartz Jet (11) is broken or clogged.	Replace quartz jet.
	Additive air is missing. Combustion gas supply is too high or too low.	Optimize flow rates.
	Substance volume is larger than linear range.	Inject lower volumes.
	White deposit on measurement electrode (for separations involving silicon)	Brush off white deposit using glass brush, blow dustfree.
	Injection device is defective.	Perform maintenance on injection device.

Thermal Conductivity Detector (TCD)

Description

This section provides preventive maintenance and repair procedures for the Thermal Conductivity Detector (TCD). Troubleshooting charts are provided should the detector fail to operate.

TCD parts should be removed or replaced only by a trained Siemens maintenance engineer or by the user's maintenance personnel trained by Siemens.

TCD Thermistor Board or Filament Board Replacement

Possible configurations for the TCD include the 2-Cell Filament Detector and the 8-Cell/4-Cell Thermistor Detector. The drawings in this section are for the 8-Cell Thermistor Detector. However, replacement of the Filament Board on the Filament Detector follows the same basic procedure. The 4-Cell Thermistor Detector is the same as the 8-Cell with only two installed thermistor boards.

It is possible to replace the Filament/Thermistor Board with the detector installed in the analyzer. Within this procedure, the numbers in parenthesis denote parts referenced in the list contained in Figure 4-57; refer back to the figure for locations.

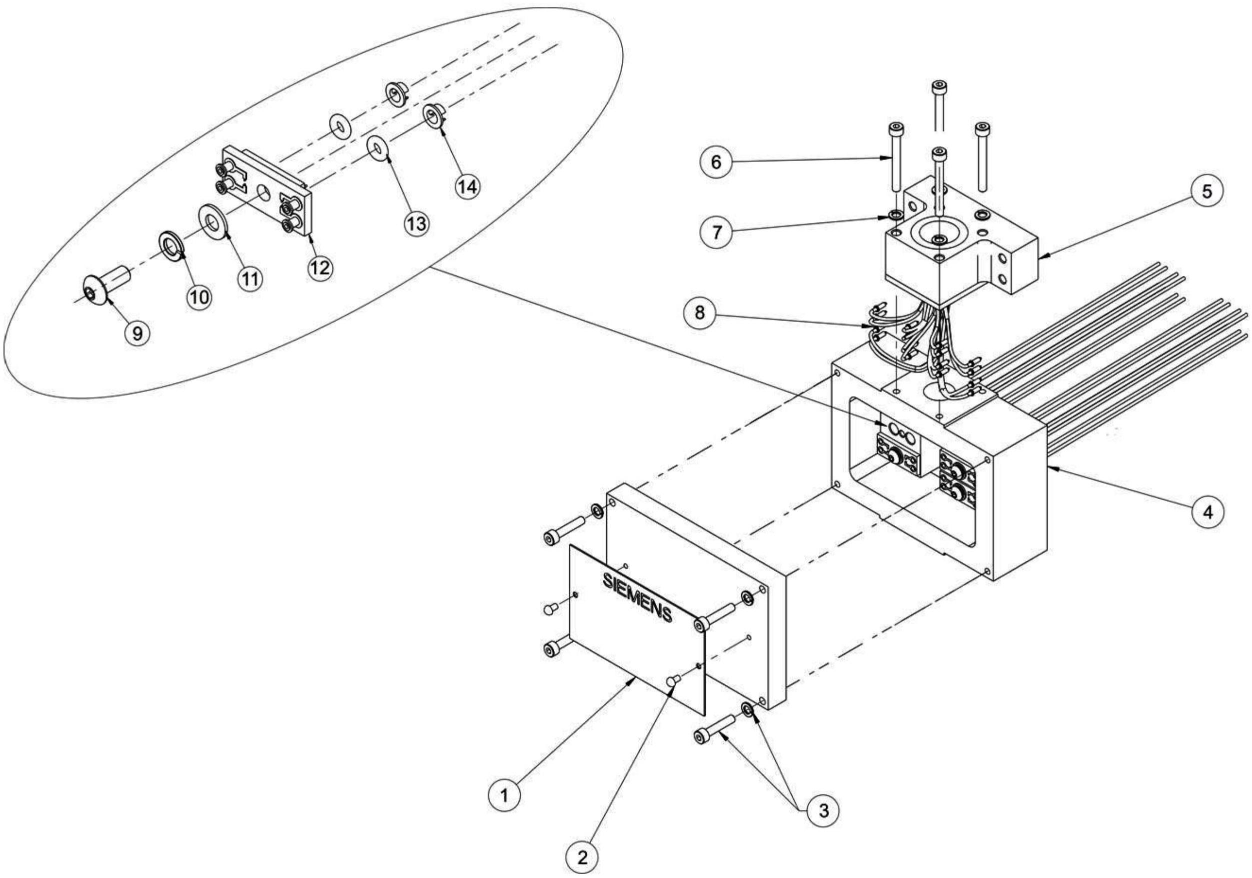
Caution ⚠

Do NOT attempt to open the TCD with the power on.

Important

When removing materials from the analyzer, all items must be placed on a clean, non-abrasive surface. Use a clean lint-free cloth.

Step	Procedure
1.	Shut off flows and shut down power to the analyzer. Allow the detector to cool down.
2.	Remove the 4 screws and lockwashers (3) that secure the cover to the detector block (4) and remove the cover.
3.	Making note of the connection location for each wire, remove the wiring (8) that is connected to the Thermistor/Filament Board (12) that is to be removed.
4.	Remove the Thermistor/Filament Board (12) by removing the Button Head Hex Screw (9), the Lockwasher (10), and the Flat Washer (11).



1. Label, Certification
2. Hammer Drive Screw (2 each)
3. Hex Head Screw and Lock Washer (4 each)
4. Detector Block
5. Detector Connector Block
6. Hex Head Screw (4 each)
7. Lock Washer (4 each)
8. Detector Wiring
9. Button Head Hex Screw
10. Lock Washer
11. Flat Washer
12. Thermistor Board (Filament Board for 2-Cell)
13. O-Ring
14. Flow Diverter (or Low Volume Metal Insert)

Figure 4-57: TCD 8-Cell Assembly

Step	Procedure
5.	Discard board (12) and O-rings (13). Do not attempt to reuse old O-rings.
6.	Remove the two metal inserts (14). These CAN be reused.
7.	Before installing new board, examine the mounting surface and the holes for the Filaments/Thermistors to verify there is no contamination or scratches on the machined surface. If there is contamination on the surface, clean it using a lint free cloth and a cleaning solvent such as acetone or hexane. If the surface is scratched it may be necessary to replace the complete assembly.
⚠	**The elements on the board are exposed and are very delicate. Handle the board only by its edges.** **Hands and tools must be clean.**
8.	Install the metal inserts (14) in the detector block (4). These inserts should be installed with the groove perpendicular to the tube holes in the block (so that air cannot flow in a straight path between the holes). Refer to Figure 4.58

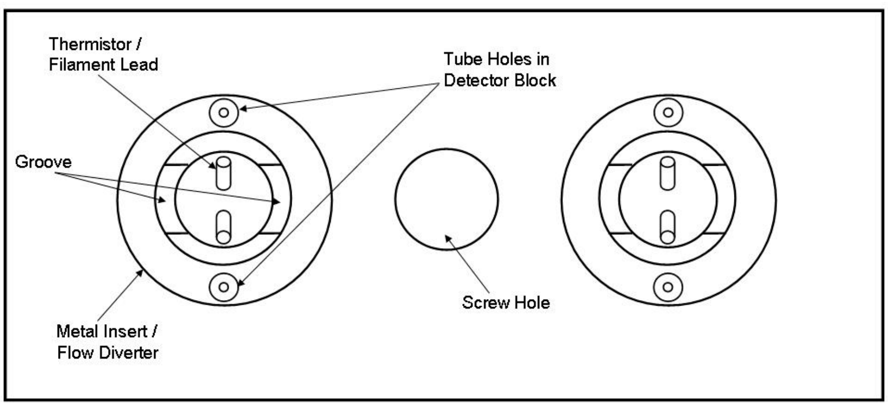


Figure 4-58: Proper Alignment of Metal Inserts

Step	Procedure
9.	Install the new O-Rings (13) in hole in the Detector Block (4). It is also possible to install the O-Rings on the Thermistor / Filament board (12) instead of in the hole. If installing the O-Rings on the board, be careful not to damage the element.
10.	Install the Board (12) into the Detector Block (4). When installing the board, exercise caution not to damage the exposed elements.
11.	Reinstall the Flat Washer (11), Lock Washer (10), and Button Head Hex Screw (9). Do not over tighten the screw as this can damage the Board (12).
12.	Reconnect wiring (8) to the board (12). Wiring MUST be connected to the same cells as before. Verify all termination points. Note: The color coding information for the wiring should be on the Detector Certification Label (1). Also note that there are two wires of each color. For a specific cell it does not matter which wire is connected to which lead as long as the color is correct.
13.	Before installing cover back on the Detector Block (4), turn on carrier air to verify there are no leaks between the Board (12) and the Block (4). Turn off carrier after this check is complete.
14.	Set the cover in place and reinstall the 4 screws and lockwashers (3) that secure the cover to the detector block (4).

Troubleshooting Chart

The following troubleshooting chart should be used in the event of a TCD failure.

Observation	Cause	Correction
Excessive noise	Chromatographic system is leaky.	Find and correct possible leaks.
	Temperatures are not stable.	Verify oven temperature.
	Measurement and supply line connections are not tight.	Retighten connections at terminal strip.
	Flow rate is too high.	Reduce flow rate.
	Column is filled improperly	Replace column.
Drift	Separation column bleeds.	Turn off TCD. Remove column from TCD and condition.
	Temperature not stabilized yet.	Await stabilization.
	Filament or Thermistor element is faulty	Replace element.

Miscellaneous Maxum II Procedures

Before You Begin

This section contains references to various procedures useful for maintenance of the Maxum II Process Gas Chromatograph. These procedures are all included in the Maxum II CD Document Library (Part Number 2000597-001) which is available from Siemens.

Maxum II Startup Procedure (Using the Workstation Software)

Startup of the Maxum II is covered in the Maxum II Installation Manual (Siemens Part Number 2000596-001). This procedure contains the elements that should be followed to restart the Maxum II after maintenance.

Backup of Maxum II Database

The procedure to backup the Maxum II Database to the System Manager PC is contained in the System Manager Overview help file of the System Manager program. The procedure is found by clicking the “How To” tab when the help file is first opened.

In addition to being part of the System Manager Software, the System Manager Overview help file is also included on the Maxum II CD Library (under the Maxum System Manager Help Files menu selection).

Alternatively, the procedure to backup the Maxum II database is included in the section of this manual titled “Maxum System Manager”.

Add an Analyzer or Connect to an Analyzer Using Workstation Software

Instructions for working with the System Manager software are included in the System Manager Overview help file. Several specific procedures can be accessed by clicking the “How To” tab when the help file is first opened. Topics covered include: adding an analyzer, connecting to an analyzer, adding an analyzer group, clearing alarms, and other topics

This help file can be accessed from the System Manager software. The help file is also included on the Maxum II CD Library (under the Maxum System Manager Help Files menu selection).

Troubleshooting

The PECM3 should start automatically once power is applied. If the unit is not operational after applying power, then review the information below to aid in correcting the problem.

The most common issue with replacing the PECM3 is cables, wiring connections, and jumpers. Check all of the cable connections to ensure that they are seated and connected properly.

The alarm system can also provide direct information on alarms for an error. Review the alarms to see if they provide an indication of the problem. These alarms have a written description which provide an indication of the problem area.

If reapplication was done with the change of the PECM, then addresses may not have been changed in the database as needed. Verify that addresses are correct if changes to the hardware occurred.

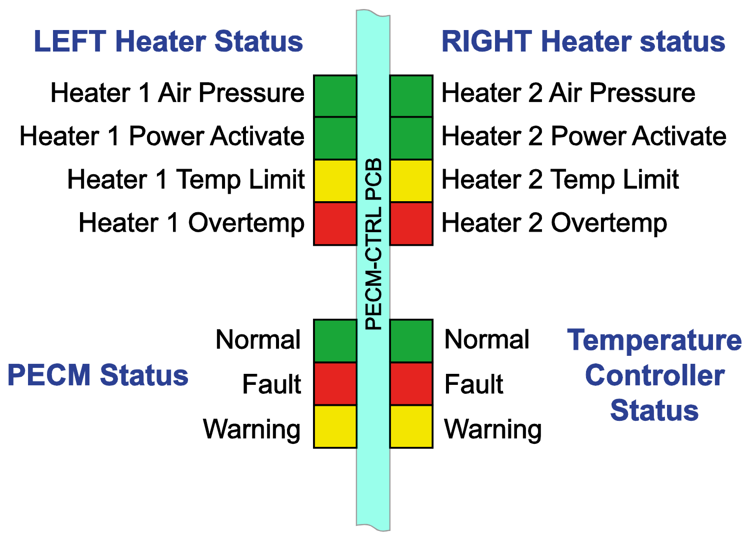
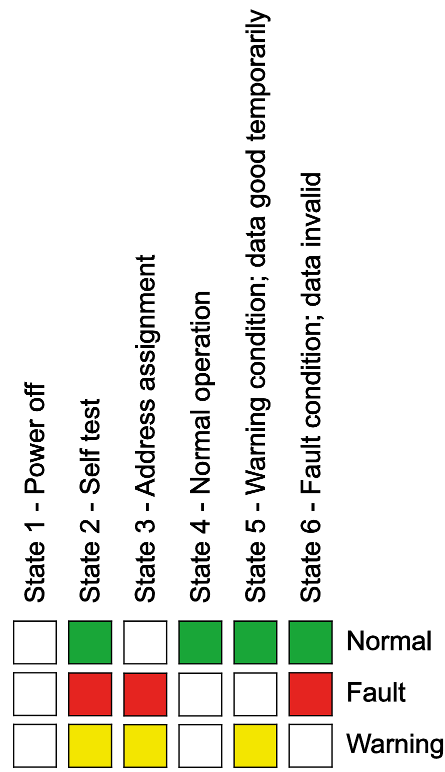


Figure 1. PECM LEDs

The LEDs on the PECM board can help with troubleshooting problems. There are two sets of LEDs: one on each side of the front board as shown in the diagram to the right. The bottom set of three LEDs is the same as used on other boards (described below.) The left set is for the PECM software and the right set is for the temperature controller software. Each will go through a separate display on power up and normal operation. The top two sets of four LEDs each are for the operation of each of the two temperature controllers on the front board. Heater 1 is on the left and heater 2 is on the right side of the board. The corrective action to take for each of the LED indications is noted below with a corrective action reference number on the diagram at the right. The normal operating state is not defined below as no corrective action is required for this state. The normal state indication is shown in the diagram below.

Corrective Action 1: The Normal, Warning, and Fault LEDs are common to most boards used in the GC electronics. There are six States, five of which are abnormal States. These are defined by LEDs with the color showing ON. The normal green LED is DIM in State 4. When communication occurs in States 4, 5, or 6, then the green normal LED will flash ON during the communication. Note that there are two sets of these (the left one for the bottom board and the right one for the top board).

If one of the abnormal States (1, 2, 3, 5, or 6) persists, then corrective action is required as noted below (corrective actions are listed in order of precedence for performing, so the user should do one item and then check to see if the issue is resolved before attempting the next item):



- State 1 –
  1. If all units in this state, then power to the analyzer and/or board is not active
  2. Reset the device or cycle power
  3. Check power connections to board (AC and 24VDC)
  4. Replace unit

- State 2
  1. Reset the device or cycle analyzer power
  2. Replace unit.

- State 3
  1. Reset the device or cycle analyzer power
  2. If all modules are in State 3, then SNECON is not communicating (check cabling and connections)
  3. Replace unit

- State 5
  4. Reset the device or cycle power
  5. Check communication cable connections

- State 6
  6. Reset the device or cycle power
  7. Check communication cable connections
  8. Check for missing Temp Limit setpoint boards
  9. Check for shorted or open RTDs.
  10. Replace the unit
  11. Replace other connected units

Corrective Action 2: Overtemp for either of the heater circuits will cause a shutdown of this circuit. It indicates that the temperature has exceeded the temperature limit point window. This maintains the temperature rating, though it says that something is not working in the control circuit. The unit must have the power reset before the circuit will begin functioning again. If this is not the result of the oven temp test button on the board to test this circuit, then the heater relays should be checked to make sure that they have not failed in the ON position, that the TL/OT temperature probes are operational, there is no loose connection of wires or connectors, and that none of the connecting wires have been switched to the wrong device.

If there is a software heater-overtemp alarm and there is no overtemp LED active on the PECM (if temperature control is done from this board), clear the alarm and see if it continues to occur. If it continues to occur, then replace the board.

If the PECM is controlling a cartridge heater, the setpoint may be too close to the limit temperature. If this is the case, then the temperature setpoint should be adjusted to a lower temperature.

Appendix A

Legacy Maxum II Modules

Overview

Description

This chapter describes each replaceable module installed within the Maxum edition II® Gas Chromatograph (a.k.a. Maxum II).

System Controller (SYSCON)

Description

The System Controller (SYSCON) functions as the control processor and motherboard for the Maxum analyzer. There have been two primary versions of SYSCON available for the Maxum, the original SYSCON and the SYSCON2. The original SYSCON is a single board, while the SYSCON2 consists of a combination of two interconnected boards. This section covers the original SYSCON. Refer to the next section for a description of the SYSCON2.

The SYSCON has a high-speed 32-bit microprocessor, a PROM chip for long term security, and battery back-up to save data in short term memory. The SYSCON stores the analyzer application database, combines all data results from the SNE and performs additional high-level data processing and calculations. All network communications, maintenance panel and analyzer functions are also coordinated by the SYSCON. The SYSCON provides communication between the Controller Board, I/O Boards and the EC operating modules; see Figure 2-3.

More information and details pertaining to the SYSCON can be found in the System Controller (SYSCON) Assembly Installation Manual (Siemens part number 2000686-001).

Additional Functions

- Processing and communicating the measurement values supplied by the SNE
- Controlling system functions, e.g. calibration
- Display and operator control
- Controlling associated systems, e.g. gas supply
- Generates reports

Mechanical

The System Controller (SYSCON) assembly is a pullout, drop-down drawer located on a slide rail assembly mounted to the upper wall of the Electronic Enclosure. The SYSCON consists of a card cage that houses the system controller board. The system controller board acts as the motherboard with onboard expansion slots to accommodate Analog and Digital I/O boards for external signal control, an Advance network communication board and a 10BASE Ethernet board.

Three primary versions of the SYSCON assembly have been available. In the original version, the power connectors are on the side and there is a CAN Bus connector on the front of the assembly. In the second version, the power connectors were moved to the bottom and the location for the CAN Bus connector, which is now optional, is on the side. Views of the first two assembly versions are shown in the figures on the next page. The newest version assembly is described in the SYSCON2 section of this chapter.

All PC boards are visible through the front of the drawer for making all I/O connections. Interface connectors to the front panel display, and communication connectors are also located and labeled on the front of the drawer.

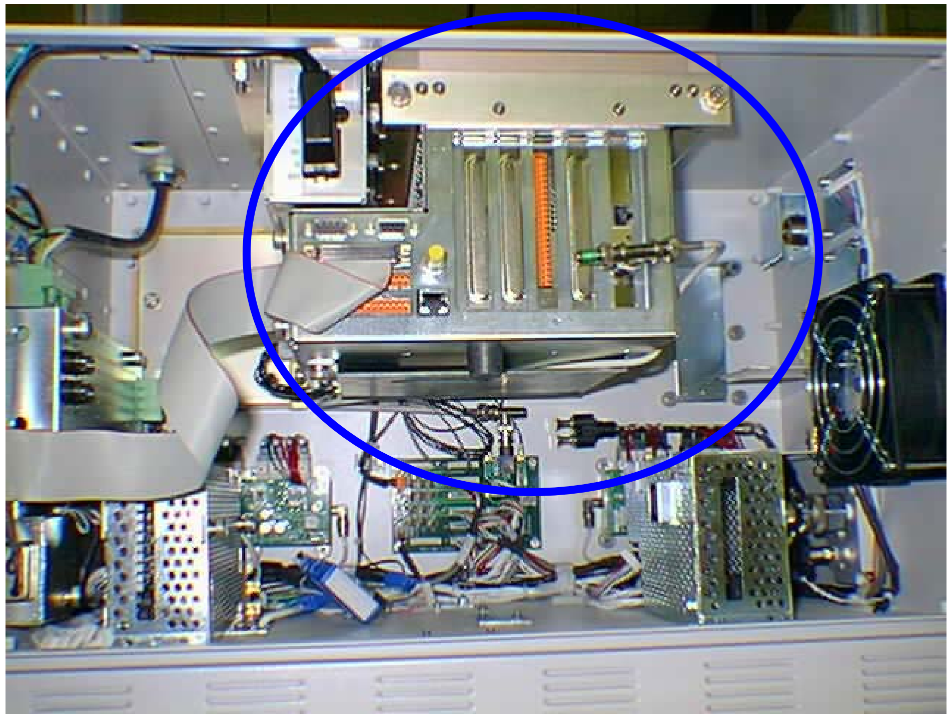


Figure 2-1 Legacy SYSCON Assembly – Original Version

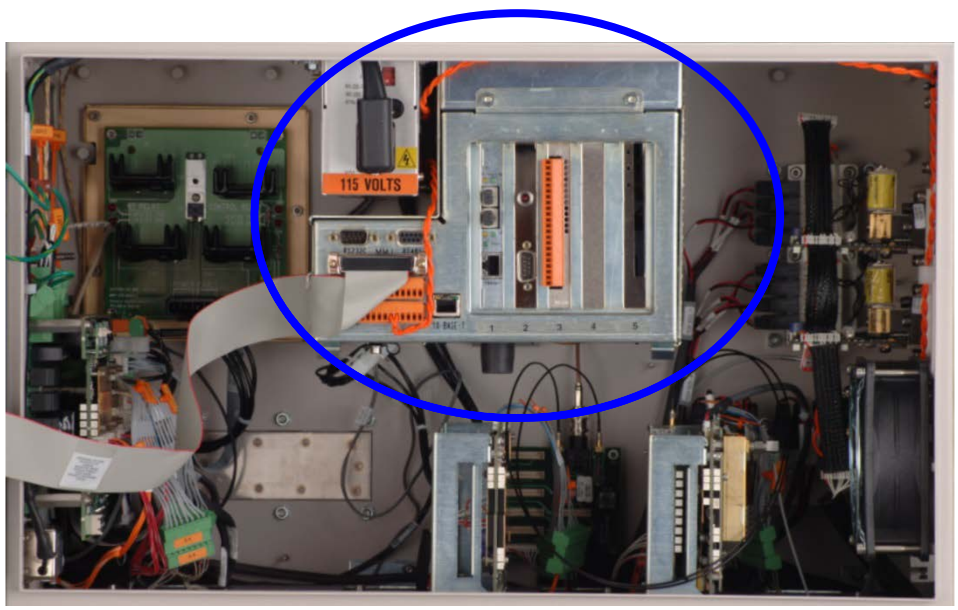


Figure 2-2 Legacy SYSCON Assembly – Second Version

System Controller (SYSCON), Continued

SYSCON Operation

The SYSCON contains the application programs and data that are accessible directly or via the external network. The SYSCON also contains the Maxum II Basic programs and the software to run the Maintenance Panel, which consists of the real time relational database and display manager.

All network communications, Maintenance Panel and analyzer functions are coordinated by the SYSCON. The SYSCON does not control sample analysis performed by the Sensor-Near Electronic Module (SNE). The SNE manages and performs all analysis functions independently of the SYSCON.

Block Diagrams

Figure 2-3 is a block diagram of the Maxum II modules.

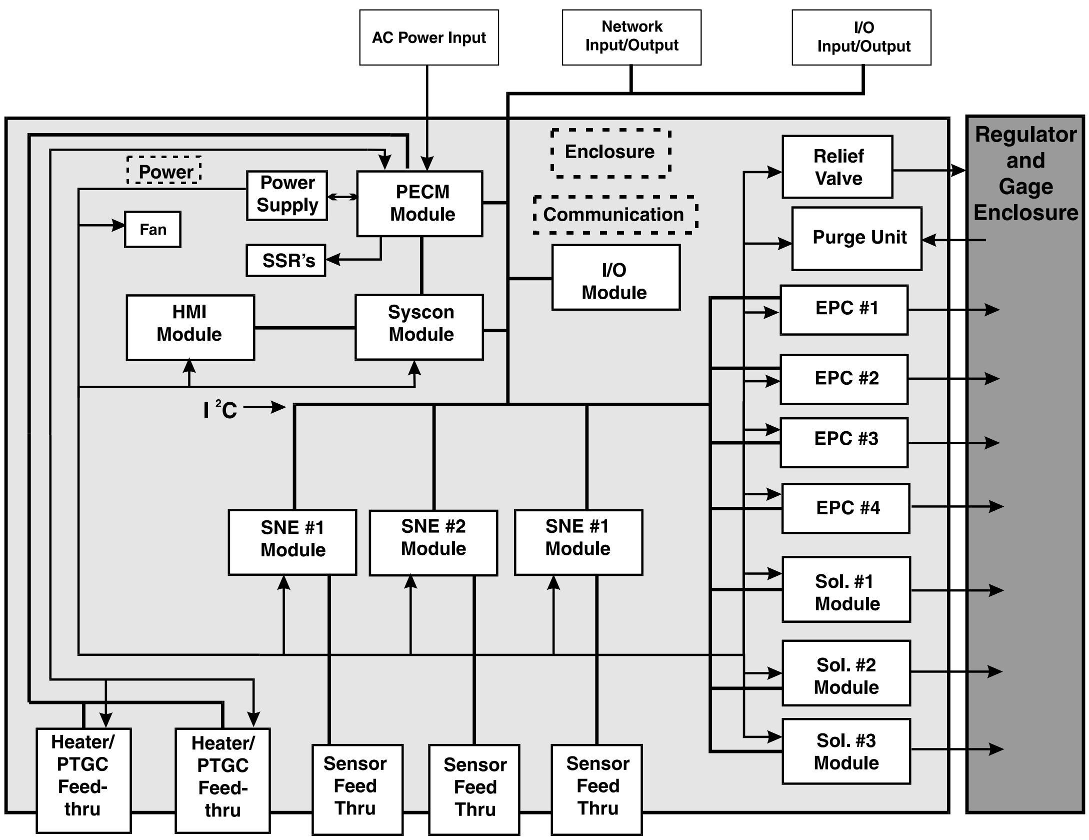


Figure 2-3 EC Installed Modules

System Controller (SYSCON), Continued

Block Diagrams continued

Figure 2-4 shows how analysis sampling information from the SNE is transferred over the 10BASET link to the SYSCON to display or archive a chromatogram.

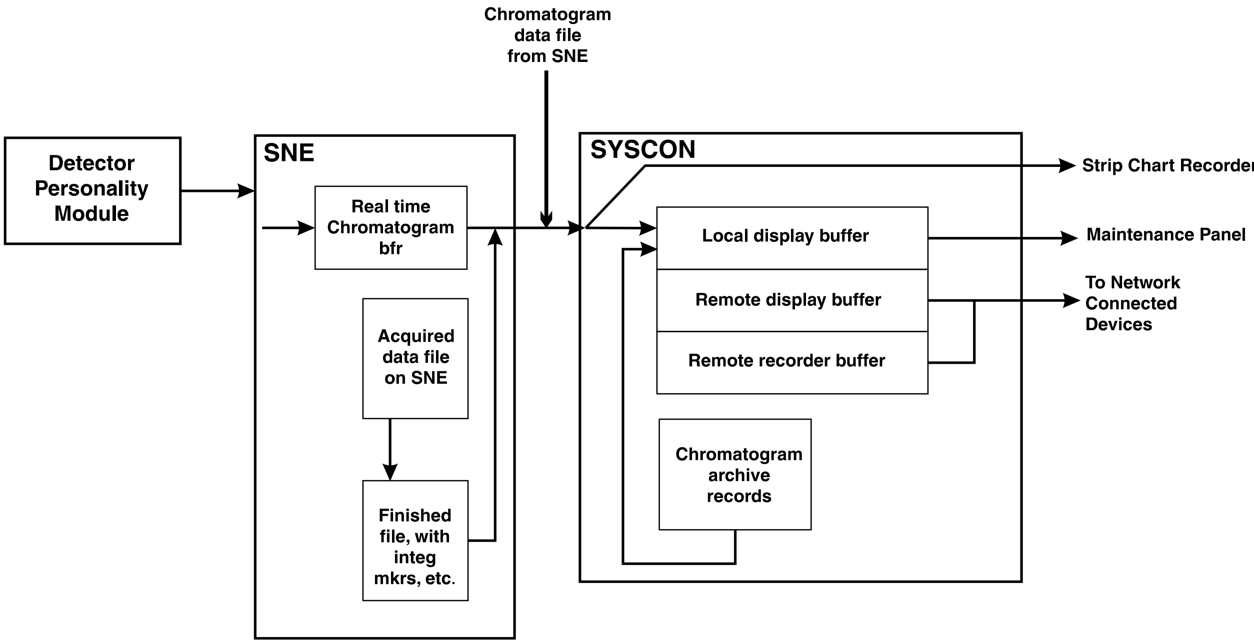


Figure 2-4 Inputs to and from SYSCON

I/O Slot Assignments

If expansion boards are added to the SYSCON Controller Board, they must be installed in the following slots. These slots are numbered from left to right when viewing SYSCON from front, see Figure 2-7: SYSCON Connections.

- Advanced Network Communication Board (ANCB) for either DataNet or Advance Data Highway (ADH): Slot #1
- 10baseT or 100baseT to Fiber Optic Conversion Board (legacy): Slot #1
- Ethernet Switch Board with Fiber, ESBF (new install) Slot #1
- No Board is installed in Slot #2. It is reserved for connecting the external debugging and reset switch assembly.
- Analog and Digital I/O Boards: Slots #3 and #4
- 10baseT ISA Ethernet Board (used on older versions of SYSCON): Slot #5
- Compact Flash Card: Slot 5

System Controller (SYSCON), Continued

Analog & Digital I/O Boards – CAN Bus

Preexisting systems use I/O boards that utilize an internal CAN bus controlled by the SYSCON. See System Controller Connections, Figure 2-8 through Figure 2-11, for connection diagrams.

- Analog I/O board (AO8): has eight channels of analog fully isolated output channels.
- Digital I/O board (DIO-8): has 4 digital inputs and 4 digital outputs
- Input/Output board: has 2 digital inputs, 2 digital outputs, 2 analog outputs, and 4 analog inputs (2 for current and 2 for voltage)
- The DOs are rated for 1A resistive load. Inductive loads are different. A DO should not drive an inductive load greater than 0.5A. An example is the typical block and bleed application which uses two parallel solenoids at 0.4A each. Separate DOs should be used to drive each solenoid. Each DO connected to a solenoid should have a diode to suppress the solenoid load.

Additional I/O Boards

In preexisting applications needing more than two I/O boards, a legacy CAN Extension Unit (CEU) may have been installed. This device allowed up to 10 additional I/O boards. The CEU, if used, connects to the Maxum II Gas Chromatograph via a Serial Link (CAN Bus).

Analog & Digital I/O Boards – I^2C bus

The newest version of I/O board connects to an I^2C bus. The I^2C I/O boards are the version generally available for new installation. See System Controller Connections, Tables 2-1 through 2-3, for connection diagrams information.

- Analog I/O board (AIO): has 8 analog output channels, 8 analog input channels, and 2 digital input channels
- Digital I/O board (DIO): has 9 digital outputs and 6 digital inputs
- Analog and Digital I/O board (ADIO): has 4 digital outputs, 4 digital inputs, 4 analog outputs, and 4 analog inputs
- The DOs are rated for 1A resistive load. Inductive loads are different. A DO should not drive an inductive load greater than 0.5A. An example is the typical block and bleed application which uses two parallel solenoids at 0.4A each. Separate DOs should be used to drive each solenoid. Each DO connected to a solenoid should have a diode to suppress the solenoid load.

Additional I/O Boards

The SYSCON supports up to two I^2C I/O boards. These boards provide approximately twice the number of circuits as previous CAN I/O boards. However, if an application needs more than two I/O boards, an NAU can be installed. This allows installation of additional I^2C I/O boards that the Maxum II can access remotely.

System Controller (SYSCON), Continued

I^{2}C I/O Board DI Mode Switch

For the I^{2}C I/O boards that contain digital inputs (DIs) switch SW1 located at the top of the board near the front (connector end) controls the mode setting for the on-board DIs. The switch sets the mode for all DI circuits on the board (mixing of modes on a board is not allowed). The available options are Default/Sink and Legacy (see back side of board for diagram of setting). The Legacy option is designed to adjust for a non-standard configuration that may be in use on some systems. The Mode switch should be set to Mode 2 unless instructed differently by Siemens.

I^{2}C I/O Board Status LEDs

Three status LEDs have been included on each I^{2}C I/O board. These LEDs are visible on the top front of the board. The LEDs follow the Maxum standard as follows:

- LED1 (Fault) - When lit, the bottom (red) LED indicates that the board has a fault.
- LED2 (Warn) - When lit, the middle (yellow) LED indicates that there is a warning status for the board.
- LED3 (Norm) - The bottom (green) LED indicates that the board is powered when lit. When this is the only LED illuminated, then the board is operating normally.

I^{2}C Bus Connections on I^{2}C I/O Boards

There are two standard I^{2}C bus connections on the top of each I^{2}C I/O board. Either of these connections may be used as either a bus input or bus extension connection. In this manner the I2C bus can daisy-chain from one board to another or to other I^{2}C devices.

I^{2}C I/O Board Address DIP Switches

The I^{2}C I/O boards use an 8-bit board identification number as an address on the I^{2}C bus. The address is a hex number from 00 to FF, corresponding to a decimal number from 0 to 255. Address numbers from 1 to 254 are used (numbers 0 and 255 are reserved).

DIP switches are used to set the address for the physical board. Older CAN I/O boards require that a user enter a MAC address that programmed onto an individual board. This necessitated the user changing the Maxum database whenever replacing a board. With the I^{2}C I/O boards, a user only needs to set the switches on the new board to match the old board being replaced.

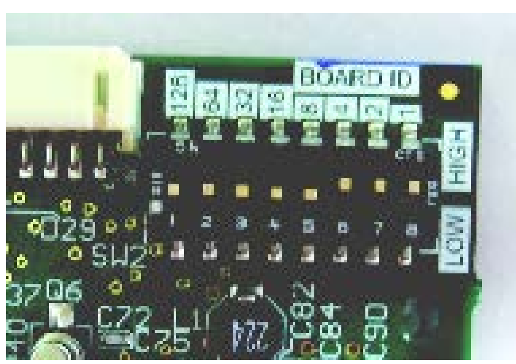


Figure 2-5 I^{2}C I/O Address Switches

System Controller (SYSCON), Continued

I²C I/O Board Address DIP Switches – Continued

The DIP switches used to set the address are on the top back part of the board and are labeled BOARD ID. Together, the DIP switches correspond to an 8 bit binary number that is set to match the board address. Each switch is labeled for the binary digit it represents, and setting a switch is equivalent to setting that bit to 1. For example, if the switches for 1, 2, and 4 are set, then the board ID would be 1+2+4 = 7.

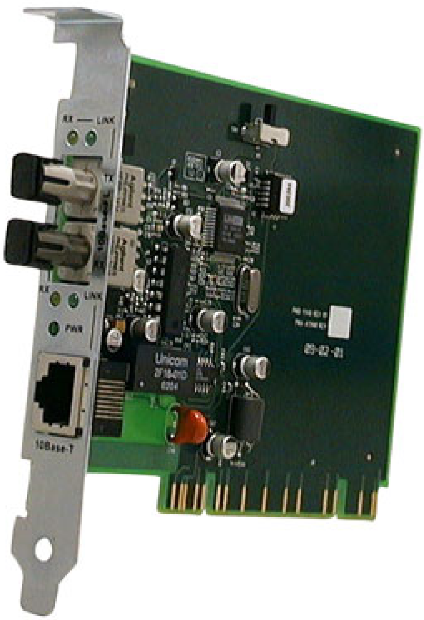
10BaseT or 100BaseT to Fiber Optic Converter Board

In existing installations, Slot 1 of the SYSCON Assembly can support a Fiber Optic Converter board. Both 100 Mb and 10 Mb versions of this board may be installed. The type of module used depends on the network configuration. The 100Base module is recommended. However, the 10Base module is has also been offered since some fiber optic switches may not support the 100Base version. In new installations the Siemens Ethernet Switch Board with Fiber (ESBF) is recommend. The ESBF is described later in this chapter.

Note that although installation in slot 1 of the SYSCON Assembly is standard, the Fiber Optic Converter board can install in any unused slot in the SYSCON Assembly (provided the crossover Ethernet Cable is long enough).

Fiber Optic Converter Board Specifications

	10Base FX Board	**100Base FX Board**
Wavelength	850 nm	1300 nm Nominal (1270-1380 nm Range)
Minimum Output Power	-16.0 dBm	-20.0 dBm
Maximum Output Power	-10.0 dBm	-14.0 dBm
Sensitivity	-32.5 dBm	-33.0 dBm
Maximum Input Power	-8.0 dBm	-8.0 dBm
Link Power Budget	16.5 dB	13.0 dB
FO Connector Type	ST (Stab & Twist)	ST
Fiber Optic cables should be Multimode (MM), with 62.5 micrometer diameter fiber core and 125 micrometer clad.		



10Base FX Version *

100Base FX Version
(Stab and Twist Connectors Not Shown)

Figure 2-6 Fiber Optic Converter Board

* The 10Base FX Version of this board is obsolete and is in the process of being discontinued by the computer networking companies that manufacture it. To prevent problems obtaining spare parts, it is recommended that the Siemens ESBF be used if possible, as described later in this chapter.

Remote Display Buffer

The *remote display buffer* transfers data to remotely connected components installed on a network. *The remote display buffer* transfers data to a peripheral connected display in lieu of the primary Maxum II's LCD display.

Local Display Buffer

The *local display buffer* outputs to the Maintenance Panel LCD can be one of the following:

- A *real-time* chromatogram of a physically installed detector,
- A view of the last EZChrom detector channel or
- An archived chromatograph record as referenced by the EZChrom channel.

System Controller (SYSCON), Continued

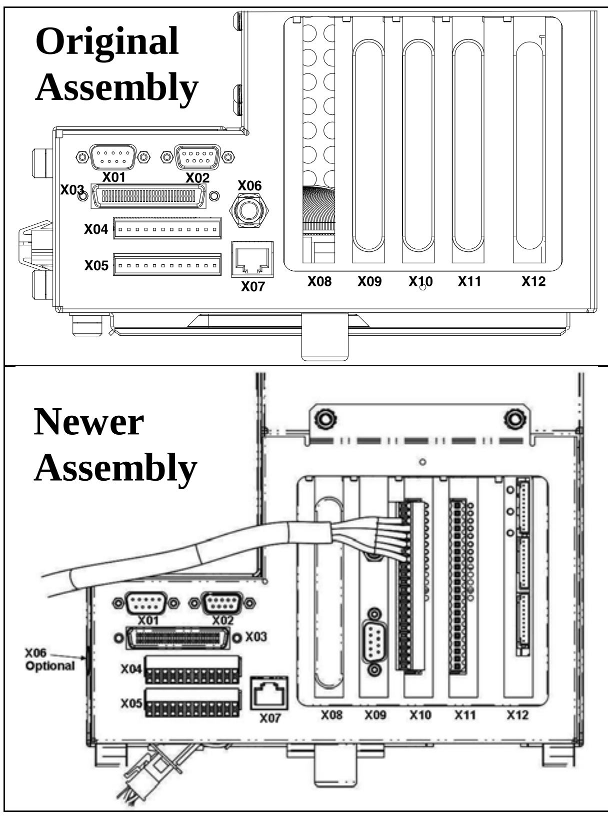
SYSCON Connections

Figure 2-6 shows the SYSCON connections. The second Ethernet connector on SYSCON is a 10BaseT connector. This connector will connect this GC to the outside world.

The Maintenance Panel connects to the front of SYSCON via a 60-pin connector (X03). Power enters SYSCON on the back left-hand side through a six-pin connector.

A 2-conductor cable from the PECM plugs into the back left hand side of SYSCON. This cable is for Maxum II purge. This plug is located directly behind the power cable plug.

An RS-485 (X01) and RS-232 (X02) port are also available on the front of SYSCON. The RS-485 port will be used for Modbus communication. The RS-232 serial port may be used to interface to a printer. There are 2 additional connectors on the front of SYSCON that are used for on board I/O. These connectors are orange in color. The on board user I/O consists of 4 DI, 4 DO, and 2 AO channels. There is also a CAN Bus connector which can be used for a CAN Extension Unit. This connector is on the front of the original SYSCON assembly. On the new assembly it is optional and is located on the left side of the assembly (if equipped).



-X01	RS-232C Port
-X02	RS-485
-X03	Maintenance Panel Connector
-X04	Digital Outputs (System Controller)
-X05	Analog & Digital Inputs
-X06	CAN Bus Connector
-X07–	Ethernet 10Base T
-X08	Communication Board (NetCom or Ethernet to Fiber Optic Converter) Slot 1
-X09	not used
-X10	I/O Board
-X11	I/O Board
-X12	10BaseT Ethernet Board

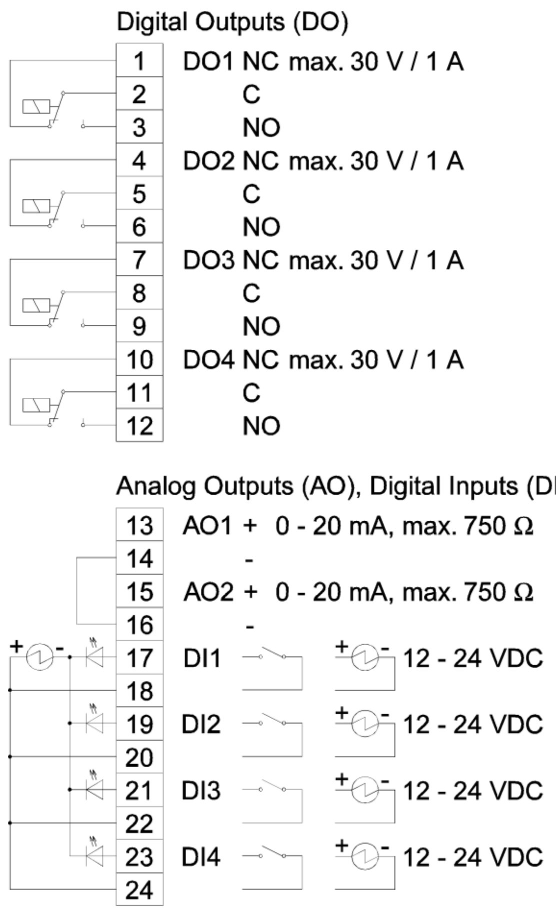
Figure 2-7 SYSCON Connections

System Controller (SYSCON), Continued

Analog & Digital Connections

Figure 2-8 to Figure 2-11 show standard input and output pin layouts for the system controller and analog/digital boards. Relays are shown in a de-energized state, equivalent to their failure mode status.

The actual pin layout with input and output signals in a delivered system will be shown in the System Documentation package.



DO1–DO4
4 digital outputs: floating double-throw contacts, max. contact load rating 30 V/ 1 A. DO1 is not administrable and is dedicated to "Maxum Fault" (active when the Maxum has an active alarm).

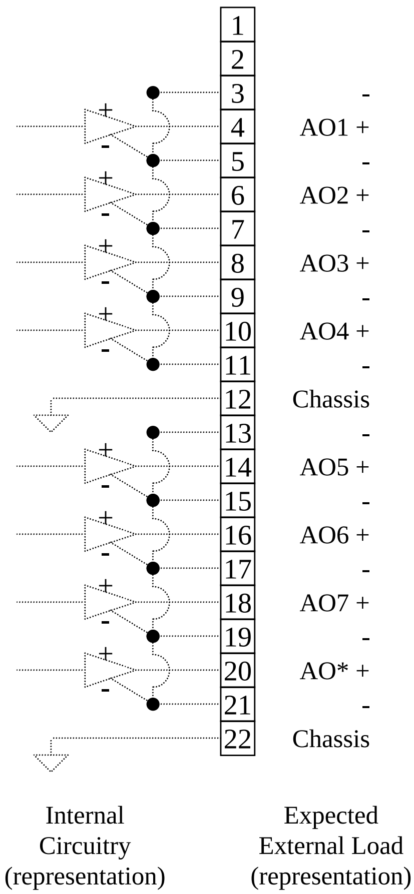
AO1–AO2
2 analog outputs: 0/4–20 mA, common negative pole, galvanically separated from ground, freely connectable to ground, max. gain vs. local protective ground potential 50 V, max. working resistance 750 Ω

DI1–DI4
4 digital inputs: Optocoupler with internal 12–24 VDC power supply, switchable with floating contacts; alternative: switchable with external 12–24 VDC supply, common negative pole

Design: Two 12-pin terminal strips for braided or solid cable with maximum cross-section of 1.5 mm^2 or 16 AWG.

Figure 2-8 System Controller Connection Diagram -X04, -X05

System Controller (SYSCON), Continued

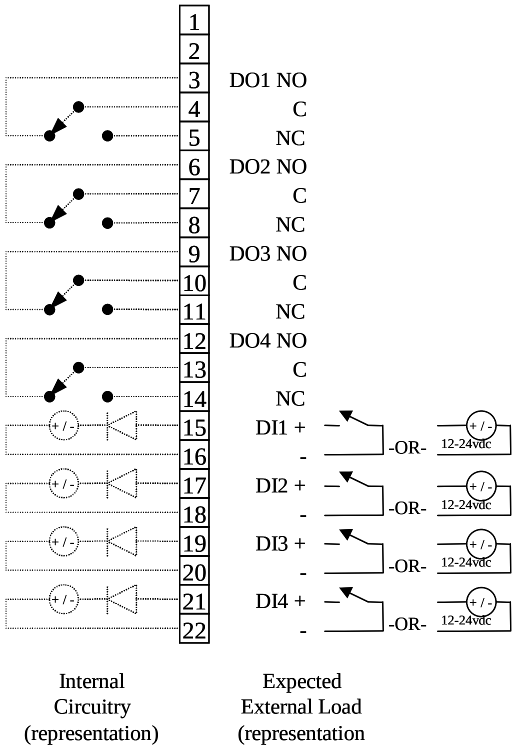


AO1-AO8
Analog Outputs: 0/4-20 mA. Common negative pole, galvanically separated from ground, freely connectable to ground, max. gain vs. local protective ground potential 50B, max. working resistance 750 ohms.

Design
One 22-pin terminal strips for braided or solid conductors with a maximum diameter of 1.5 mm or 16 AWG.

Figure 2-9 CAN Analog Output Board Connection Diagram -X10 - -X11

System Controller (SYSCON), Continued



DO1-DO4
Digital Outputs: Floating double-throw contacts, max. contact load rating 30 V/1A.

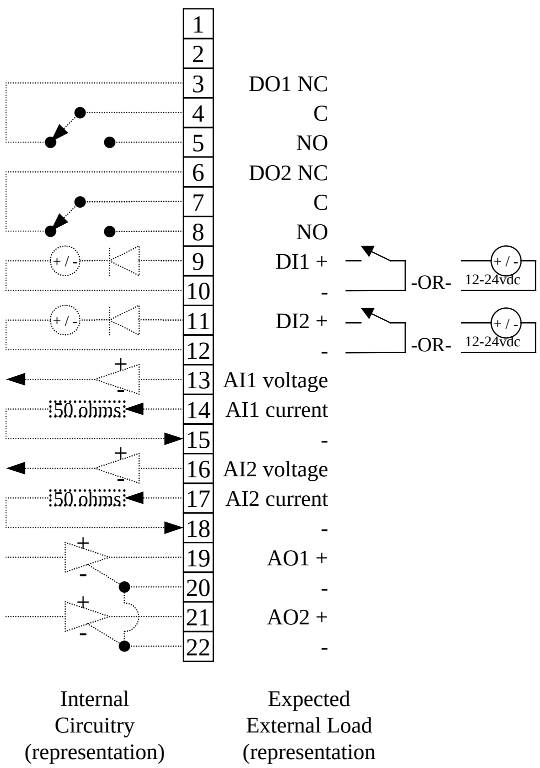
The DO's are rated for 1A resistive load. Inductive loads are different. A DO should not drive an inductive load greater than 0.5A. The typical block and bleed application, which uses two parallel solenoids at 0.4A each, should use separate DO's to drive each solenoid. Each DO connected to a solenoid should have a diode to suppress the solenoid load.

DI1-DI4
Digital Inputs: Optocoupler with internal 12-24 VDC power supply, switchable with floating contacts; alternative: switchable with external voltage 12-24 VDC, common negative pole.

Design
One 22-pin terminal strips for braided or solid conductors with a maximum diameter of 1.5 mm or 16 AWG.

Figure 2-10 CAN Digital I/O Board Connections Diagram -X10 - -X11

System Controller (SYSCON), Continued



DO1-DO2
Digital Outputs: Floating double-throw contacts, max. contact load rating 30 V/1A

DI1-DI2
Digital Inputs: Optocoupler with internal 12-24 VDC power supply, switchable with floating contacts; alternative: switchable with external voltage 12-24 VDC, common negative pole.

AI1-AI2
Analog Inputs: -20 to +20 mA into 50 ohms or -10 to +10V, R_{10}=1 M-ohm, mutually isolated 10 V

AO1-AO2
Analog Outputs: 0/4-20 mA. Common negative pole, galvanically separated from ground, freely connectable to ground, max. gain vs. local protective ground potential 50B, max. working resistance 750 ohms.

Design
One 22-pin terminal strips for braided or solid conductors with a maximum diameter of 1.5 mm or 16 AWG.

Figure 2-11 CAN Combination Analog/Digital I/O Board Connection Diagram X10-X11

System Controller (SYSCON), Continued

Analog I/O Board (AIO) Connections

Circuits on the AIO board are wired as shown in the following table. The table is the view is as seen when looking at the connector while the board is installed.

AIO I²C Wire Side View					
Lead	**Pin**			**Pin**	**Lead**
AI8 -10V	2	∎	∎	1	AI8 +10V
AI7 -10V	4	∎	∎	3	AI7 +10V
AI6 -10V	6	∎	∎	5	AI6 +10V
AI5 -10V	8	∎	∎	7	AI5 +10V
AI4 -10V	10	∎	∎	9	AI4 +10V
AI3 -10V	12	∎	∎	11	AI3 +10V
AI2 -10V	14	∎	∎	13	AI2 +10V
AI1 -10V	16	∎	∎	15	AI1 +10V
AO_GND	18	∎	∎	17	AO8 Current
AO_GND	20	∎	∎	19	AO7 Current
AO_GND	22	∎	∎	21	AO6 Current
AO_GND	24	∎	∎	23	AO5 Current
AO_GND	26	∎	∎	25	AO4 Current
AO_GND	28	∎	∎	27	AO3 Current
AO_GND	30	∎	∎	29	AO2 Current
AO_GND	32	∎	∎	31	AO1 Current
DI Common	34	∎	∎	33	DI2 Signal
DI Common	36	∎	∎	35	DI1 Signal

Analog Inputs: -20 to +20 mA into 50 ohms or -10 to +10V, R_{10}=1 M-ohm, mutually isolated 10 V

Analog Outputs: 0/4-20 mA. Common negative pole, galvanically separated from ground, freely connectable to ground, max. gain vs. local protective ground potential 50B, max. working resistance 750 ohms.

Digital Inputs: Optocoupler with internal 12-24 VDC power supply, switchable with floating contacts; alternative: switchable with external voltage 12-24 VDC, common negative pole.

Design: Terminal strips for braided or solid conductors with a maximum diameter of 1.5 mm or 16 AWG.

Figure 2-12 I²C AIO Board Connection Diagram -X10 - -X11

System Controller (SYSCON), Continued

Digital I/O Board (DIO) Connections

Circuits on the DIO board are wired as shown in the following table. The table is the view is as seen when looking at the connector while the board is installed.

DIO I²C Wire Side View					
Lead	Pin			Pin	Lead
DI Common	2	∎	∎	1	DI6 Signal
DI Common	4	∎	∎	3	DI5 Signal
DI Common	6	∎	∎	5	DI4 Signal
DI Common	8	∎	∎	7	DI3 Signal
DI Common	10	∎	∎	9	DI2 Signal
DI Common	12	∎	∎	11	DI1 Signal
DO8 C	14	∎	∎	13	DO8 NC
DO7 NC	16	∎	∎	15	DO8 NO
DO7 NO	18	∎	∎	17	DO7 C
DO6 C	20	∎	∎	19	DO6 NC
DO5 NC	22	∎	∎	21	DO6 NO
DO5 NO	24	∎	∎	23	DO5 C
DO4 C	26	∎	∎	25	DO4 NC
DO3 NC	28	∎	∎	27	DO4 NO
DO3 NO	30	∎	∎	29	DO3 C
DO2 C	32	∎	∎	31	DO2 NC
DO1 NC	34	∎	∎	33	DO2 NO
DO1 NO	36	∎	∎	35	DO1 C

Digital Inputs: Optocoupler with internal 12-24 VDC power supply, switchable with floating contacts; alternative: switchable with external voltage 12-24 VDC, common negative pole.

Digital Outputs: Digital Outputs: Floating double-throw contacts, max. contact load rating 30 V/1A

The DOs are rated for 1A resistive load. Inductive loads are different. A DO should not drive an inductive load greater than 0.5A. The typical block and bleed application, which uses two parallel solenoids at 0.4A each, should use separate DOs to drive each solenoid. Each DO connected to a solenoid should have a diode to suppress the solenoid load.

Design: Terminal strips for braided or solid conductors with a maximum diameter of 1.5 mm or 16 AWG.

Figure 2-13 I²C DIO Board Connection Diagram -X10 - -X11

System Controller (SYSCON), Continued

Analog and Digital I/O Board (ADIO)

Circuits on the ADIO board are wired as shown in the following table. The table is the view is as seen when looking at the connector while the board is installed.

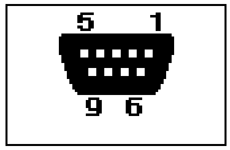
ADIO I²C Wire Side View					
Lead	**Pin**			**Pin**	**Lead**
AI4 -10V	2	∎	∎	1	AI4 +10V
AI3 -10V	4	∎	∎	3	AI3 +10V
AI2 -10V	6	∎	∎	5	AI2 +10V
AI1 -10V	8	∎	∎	7	AI1 +10V
DI Common	10	∎	∎	9	DI4 Signal
DI Common	12	∎	∎	11	DI3 Signal
DI Common	14	∎	∎	13	DI2 Signal
DI Common	16	∎	∎	15	DI1 Signal
AO_GND	18	∎	∎	17	AO4 Current
AO_GND	20	∎	∎	19	AO3 Current
AO_GND	22	∎	∎	21	AO2 Current
AO_GND	24	∎	∎	23	AO1 Current
DO4 C	26	∎	∎	25	DO4 NC
DO3 NC	28	∎	∎	27	DO4 NO
DO3 NO	30	∎	∎	29	DO3 C
DO2 C	32	∎	∎	31	DO2 NC
DO1 NC	34	∎	∎	33	DO2 NO
DO1 NO	36	∎	∎	35	DO1 C
Analog Inputs: -20 to +20 mA into 50 ohms or -10 to +10V, R_{10}=1 M-ohm, mutually isolated 10 V **Analog Outputs:** 0/4-20 mA. Common negative pole, galvanically separated from ground, freely connectable to ground, max. gain vs. local protective ground potential 50B, max. working resistance 750 ohms. **Digital Inputs:** Optocoupler with internal 12-24 VDC power supply, switchable with floating contacts; alternative: switchable with external voltage 12-24 VDC, common negative pole. **Digital Outputs:** Digital Outputs: Floating double-throw contacts, max. contact load rating 30 V/1A **Design:** Terminal strips for braided or solid conductors with a maximum diameter of 1.5 mm or 16 AWG.					

Figure 2-14 I²C ADIO Board Connection Diagram -X10 - -X11

System Controller (SYSCON), Continued

Communication Ports

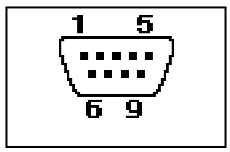
Figure 2-15 through Figure 2-17 show the wiring requirements for the communication port connectors.



3 RS485 A
5 Common
8 RS485 B

Design: 9-pin Sub D female connector

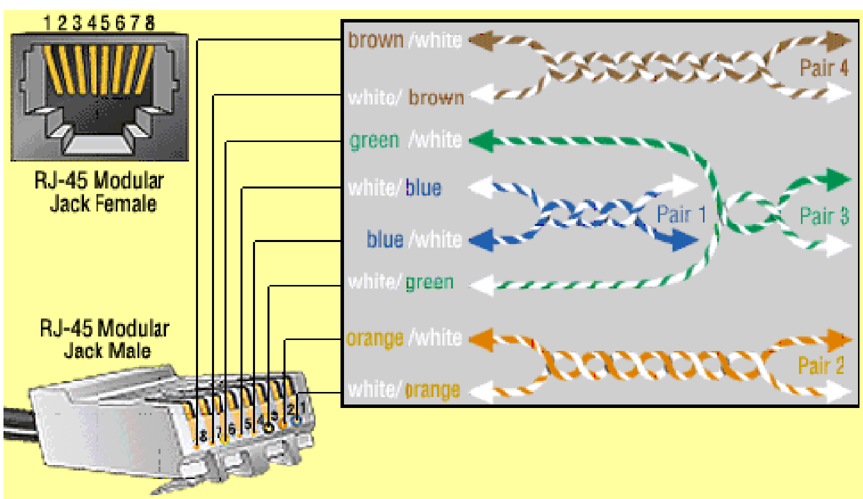
Figure 2-15 RS-485 Port -X02



2 RxD
3 TxD
5 GND

Design: 9-pin Sub D male connector

Figure 2-16 RS-232C Port -X01



1 10TT+
2 10TT–
3 10TR+
6 10TR–

Design: 8-pin RJ45 Jack Using Pairs 2 & 3

Figure 2-17 Ethernet 10BASET Port -X07

System Controller (SYSCON), Continued

SYSCON Controller Board Layout

Figure 2-18 shows the layout of the System Controller Board.

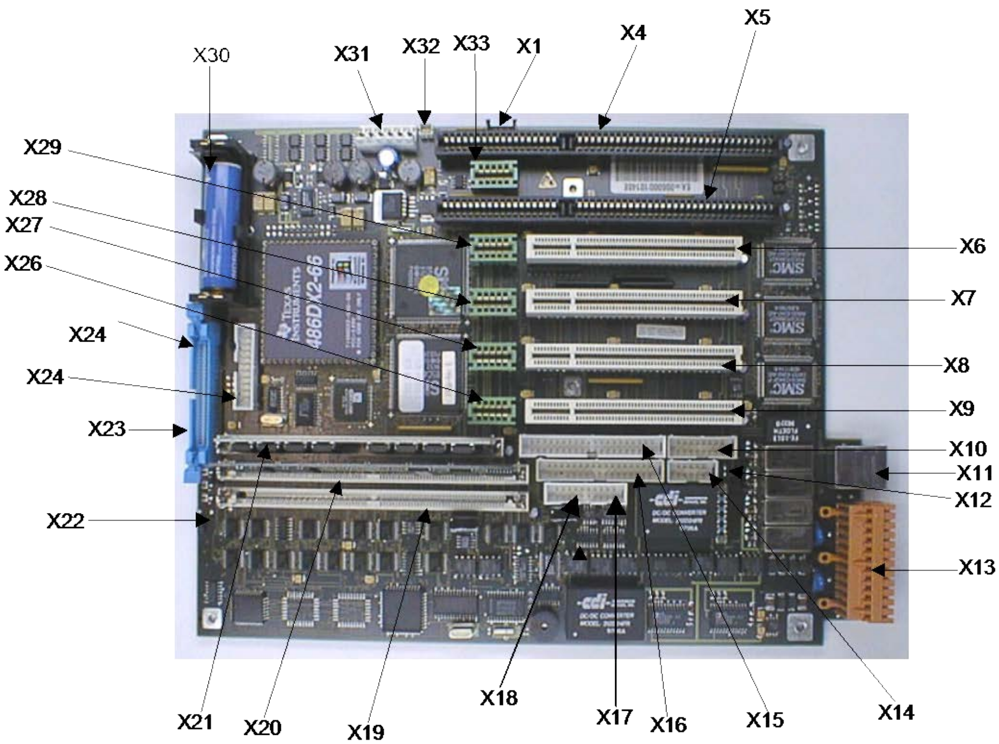


Figure 2-18 System Controller

Inputs/Outputs

X1	Internal bus	X18	RS 485
X2	Reserved	X19	SIMM 80 #2 Flash/SRAM
X3	Reserved	X20	SIMM 80 #1 Flash/DRAM
X4	AT Bus 1	X21	SIMM 72
X5	AT Bus 2	X22	Reset contact
X6	PCI Slot 4	X23	Display
X7	PCI Slot 3	x24	Dongle plug
X8	PCI Slot 2	X25	Keyboard
X9	PCI Slot 1	X26	CAN Direct 5
X10	AUI	X27	CAN Direct 4
X11	10BaseT	X28	CAN Direct 3
X12	Internal bus	X29	CAN Direct 2
X13	I/O	X30	Battery
X14	RS 232 (Debug)	X31	Power
X15	Not used at this time	X32	Purge
X16	Not used at this time	X33	CAN Direct 1
X17	RS 232		

System Controller (SYSCON), Continued

Interface Description

See Figure 2-18 for location of interface connections.

X1

Internal bus

Pin	Signal
1	GND
2	CAN L
3	CAN H
4	GND

X2 / X3

Not used at this time

X4

AT Bus

Pin	Signal	Pin	Signal
A1	IOCHK#	B1	GND
A2	SD7	B2	RSTDRV
A3	SD6	B3	5 Volt
A4	SD5	B4	IRQ 9
A5	SD4	B5	-5 Volt
A6	SD3	B6	DRQ 2
A7	SD2	B7	-12 Volt
A8	SD1	B8	WS 0#
A9	SD0	B9	12 Volt
A10	IOCHRDY	B10	GND
A11	AEN	B11	SMEMW #
A12	SA19	B12	SMEMR #
A13	SA18	B13	IOW #
A14	SA17	B14	IOR #
A15	SA16	B15	DACK 3#
A16	SA15	B16	DRQ 3
A17	SA14	B17	DACK 1#
A18	SA13	B18	DRQ 1
A19	SA12	B19	REFRESH #
A20	SA11	B20	AT Clock
A21	SA10	B21	IRQ 7
A22	SA9	B22	IRQ 6
A23	SA8	B23	IRQ 5
A24	SA7	B24	IRQ 4
A25	SA6	B25	IRQ 3
A26	SA5	B26	DACK 2#
A27	SA4	B27	T/C
A28	SA3	B28	BALE
A29	SA2	B29	5 Volt
A30	SA1	B30	OSC 14
A31	SA0	B31	GND

System Controller (SYSCON), Continued

Pin	Signal	Pin	Signal
C1	SBHE #	D1	MEMCS16 #
C2	LA 23	D2	IOCS16 #
C3	LA 22	D3	IRQ 10
C4	LA 21	D4	IRQ 11
C5	LA 20	D5	IRQ 12
C6	LA 19	D6	IRQ 13
C7	LA 18	D7	IRQ 14
C8	LA 17	D8	DACK 0 #
C9	MEMR #	D9	DRQ 0
C10	MEMW #	D10	DACK 5
C11	SD 8	D11	DRQ 5
C12	SD 9	D12	DACK 6 #
C13	SD 10	D13	DRQ 6
C14	SD 11	D14	DACK 7 #
C15	SD 12	D15	DRQ 7
C16	SD 13	D16	5 Volt
C17	SD 14	D17	Master #
C18	SD 15	D18	GND

X5

AT Bus 2, layout per X5 AT Bus 1

X6

PCI Slot 1

Pin	Signal	Pin	Signal
A1	N.C.	B1	-12 V
A2	12 Volt	B2	N.C.
A3	N.C.	B3	GND
A4	N.C.	B4	N.C.
A5	5 Volt	B5	5 Volt
A6	INT D	B6	5 Volt
A7	INT B	B7	INT A
A8	5 Volt	B8	INT C
A9	N.C.	B9	N.C.
A10	5 Volt	B10	N.C.
A11	N.C.	B11	N.C.
A12	GND	B12	GND
A13	GND	B13	GND
A14	N.C.	B14	N.C.
A15	RESET	B15	GND
A16	5 Volt	B16	CLK
A17	GNT 0	B17	GND
A18	GND	B18	REQ 0 #

System Controller (SYSCON), Continued

Pin	Signal	Pin	Signal
A19	N.C.	B19	5 Volt
A20	AD 30	B20	AD 31
A21	3.3 Volt	B21	AD 29
A22	AD 28	B22	GND
A23	AD 26	B23	AD 27
A24	GND	B24	AD 25
A25	AD 24	B25	#.3 Volt
A26	IDSEL	B26	CBE3 #
A27	3.3 Volt	B27	AD 23
A28	AD 22	B28	GND
A29	AD 20	B29	AD 21
A30	GND	B30	AD 19
A31	AD 18	B31	3.3 Volt
A32	AD 16	B32	AD 17
A33	3.3 Volt	B33	CBE 2 #
A34	FRAME #	B34	GND
A35	GND	B35	IRDY #
A36	TRDY #	B36	3.3 Volt
A37	GND	B37	DEVSEL #
A38	STOP #	B38	GND
A39	3.3 Volt	B39	LOCK #
A40	N.C.	B40	N.C.
A41	N.C.	B41	3.3 Volt
A42	GND	B42	SERROR #
A43	PARITY	B43	3.3 Volt
A44	AD 15	B44	CBE 2 #
A45	3.3 Volt	B45	AD 14
A46	AD 13	B46	GND
A47	AD 11	B47	AD 12
A48	GND	B48	AD 10
A49	AD 9	B49	GND
A50	(keyed)	B50	(keyed)
A51	(keyed)	B51	(keyed)
A52	CBE0 #	B52	AD 8
A 53	3.3 Volt	B53	AD 7
A54	AD 6	B54	3.3 Volt
A55	AD 4	B55	AD 5
A56	GND	B56	AD 3
A57	AD 2	B57	GND
A58	AD 0	B58	AD 1
A59	5 Volt	B59	5 Volt
A60	N.C.	B60	N.C.
A61	5 Volt	B61	5 Volt
A62	5 Volt	B62	5 Volt

System Controller (SYSCON), Continued

X7 / X8 / X9

PCI Slot 2, layout per X6 PCI Slot 1

X10

Not used at this time

X11

Ethernet interface

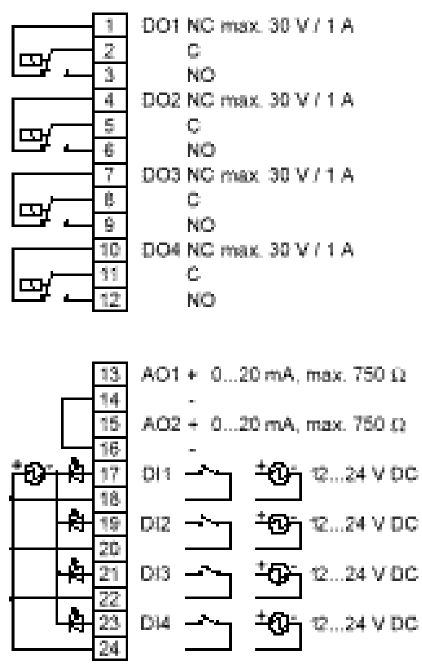
Pin	Signal	Pin	Signal
1	Transmit +	2	Transmit -
3	Receive +	4	N.C.
5	N.C.	6	Receive -
7	N.C.	8	N.C.

X12

Internal bus, see X1 for layout

X13

I/O contacts



System Controller (SYSCON), Continued

X14

RS 232

Pin	Signal	Pin	Signal
1	DCD	2	RXD
3	TXD	4	DTR
5	GND	6	DSR
7	RTS	8	CTS
9	RI		

X15 / X16

Not used at this time

X17

V24 interface

Pin	Signal	Pin	Signal
1	N.C.	2	DATA+
3	DATA-	4	N.C.
5	N.C.	6	N.C.
7	N.C.	8	N.C.
9	N.C.	10	N.C.

X18

RS485

Pin	Signal	Pin	Signal
1	N.C.	2	DATA+
3	DATA-	4	N.C.
5	GND.	6	N.C.
7	N.C.	8	N.C.
9	N.C.	10	N.C.

System Controller (SYSCON), Continued

X19

SIMM 80 #2

Pin	Signal	Pin	Signal
1	GND	41	GND
2	Data 0	42	ByteEnable 0 #
3	Data 1	43	ByteEnable 1 #
4	Data 2	44	ByteEnable 2 #
5	Data 3	45	ByteEnable 3 #
6	5 Volt	46	5 Volt
7	Data 4	47	Adr 2
8	Data 5	48	Adr 3
9	Data 6	49	Adr 4
10	Data 7	50	Adr 5
11	GND	51	Adr 6
12	Data 8	52	Adr 7
13	Data 9	53	Adr 8
14	Data 10	54	Adr 9
15	Data 11	55	Adr 10
16	5 Volt	56	Adr 11
17	Data 12	57	Adr 12
18	Data 13	58	Adr 13
19	Data 14	59	5 Volt
20	Data 15	60	Adr 14
21	GND	61	Adr 15
22	Data 16	62	Adr 16
23	Data 17	63	Adr 17
24	Data 18	64	Adr 18
25	Data 19	65	Adr 19
26	5 Volt	66	Adr 20
27	Data 20	67	Adr 21
28	Data 21	68	Adr 22
29	Data 22	69	Adr 23
30	Data 23	70	Adr 24
31	GND	71	GND
32	Data 24	72	Battery +
33	Data 25	73	NC
34	Data 26	74	SRAM-ChipSelect #
35	Data 27	75	FLASH-ChipSelect #
36	5 Volt	76	SRAM-WriteEnable #
37	Data 28	77	FLASH-WriteEnable #
38	Data 29	78	SRAM/FLASH-ReadEnble #
39	Data 30	79	GND
40	Data 31	80	12Volt

System Controller (SYSCON), Continued

X20

SIMM 80 #1, for layout see X19 SIMM 80 #2

X21

SIMM 72

Pin	Signal	Pin	Signal
1	GND	37	Parity 1
2	Data 0	38	Parity 3
3	Data 16	39	GND
4	Data 1	40	CAS 0 #
5	Data 17	41	CAS 2 #
6	Data 2	42	CAS 3 #
7	Data 18	43	CAS 1 #
8	Data 3	44	RAS 0 #
9	Data 19	45	RAS 1 #
10	Data 4	46	NC
11	NC	47	Write #
12	Adr 0	48	NC
13	Adr 1	49	Data 8
14	Adr 2	50	Data 24
15	Adr 3	51	Data 9
16	Adr 4	52	Data 25
17	Adr 5	53	Data 10
18	Adr 6	54	Data 26
19	Adr 10	55	Data 11
20	Data 4	56	Data 27
21	Data 20	57	Data 12
22	Data 5	58	Data 28
23	Data 21	59	5 Volt
24	Data 6	60	Data 29
25	Data 22	61	Data 13
26	Data 7	62	Data 30
27	Data 23	63	Data 14
28	Adr 7	64	Data 31
29	Adr 11	65	Data 15
30	5 Volt	66	NC
31	Adr 8	67	ID 1 / NC
32	Adr 9	68	ID 2 / NC
33	RAS 3 #	69	ID 3 / NC
34	RAS 2 #	70	ID 4 / NC
35	Parity 2	71	NC
36	Parity 0	72	GND

System Controller (SYSCON), Continued

X23

Control/display unit plug (Maintenance Panel (also called HMI))

Pin	Signal	Pin	Signal
1	GND	2	GND
3	Address 0	4	Address 1
5	Address 2	6	Address 3
7	Address 4	8	Address 5
9	Address 6	10	Address 7
11	Address 8	12	Address 9
13	Address 10	14	Address 1
15	Address 12	16	Address 13
17	Address 14	18	Address 15
19	5 Volt	20	HMI-ChipSelect #
21	5 Volt	22	Data 0
23	Data 1	24	Data 2
25	Data 3	26	Data 4
27	Data 5	28	Data 6
29	Data 7	30	5 Volt
31	GND	32	ISA-System Clock
33	GND	34	5 Volt
35	N.C.	36	Memory Write #
37	MemoryRead #	38	Reset #
39	5 Volt	40	IO-Channel Ready
41	5 Volt	42	RXD
43	TXD	44	RTS
45	CTS	46	DTR
47	DSR	48	DCD
49	RI	50	HMI GPO 0
53	N.C.	54	Interrupt
55	HMI Purge LED	56	HMI_MNT-LED
57	Failure LED	58	GND
59	GND	60	GND

X24

Dongle plug

X25

Keyboard connector

Pin	Signal
1	5 Volt
2	Keyboard Clock
3	Keyboard Data
4	(keyed)
5	GND

System Controller (SYSCON), Continued

X26

CAN Direct 5

Pin	Signal	Pin	Signal
1	CAN H	2	CAN H
3	CAN L	4	CAN L
5	GND	6	GND
7	24 Volt	8	24 Volt
9	N.C.	10	N.C.

X27 / X28 / X29

CAN Direct 4, for layout see X26

X30

Power

Pin	Signal
1	NC
2	PWR PRIM
3	GND
4	GND
5	24 Volt
6	24 Volt

X31

Not used at this time

X32

CAN Direct 1, for layout see X26

System Controller Version 2 (SYSCON2)

Description

The System Controller (SYSCON) functions as the control processor and motherboard for the Maxum analyzer. There have been two primary versions of SYSCON available for the Maxum, the original SYSCON and the SYSCON2. The original SYSCON is a single board, while the SYSCON2 consists of a combination of two interconnected boards. This section covers the SYSCON2. Refer to the previous section for a description of the original SYSCON.

The SYSCON2 consists of two boards, the Communication and Analytical Control (CAC3) board and the SYSCON Interface Board (SIB). The CAC3 contains the processor and memory functions for the SYSCON2 as well as control of external Ethernet communications (via the Ethernet Switch Board). The CAC3 is mounted on and operates in conjunction with the SIB. With the exception of external Ethernet, the SIB contains all interfaces provided by the SYSCON2.

The CAC3 on the SYSCON2 stores the analyzer application database, combines all data results from the SNE and performs additional high-level data processing and calculations. All network communications, maintenance panel and analyzer functions are also coordinated by the SYSCON2. The SYSCON2 provides communication between the Controller Board, I/O Boards and the EC operating modules in the same way as the original SYSCON; refer back to figure 2-3.

More information and details pertaining to the SYSCON can be found in the System Controller version 2 (SYSCON2) Installation Manual (Siemens part number A5E02643617001).

Additional Functions

- Processing and communicating the measurement values supplied by the SNE
- Controlling system functions, e.g. calibration
- Display and operator control
- Controlling associated systems, e.g. gas supply
- Generates reports

Software Support

The SYSCON2 is supported only by software version 5.0 or greater. For software versions below 5.0, the original version SYSCON is required.

System Controller Version 2 (SYSCON2), Continued

Mechanical

The SYSCON2 resides in the SYSCON assembly. This assembly is a pullout, drop-down drawer located on a slide rail assembly mounted to the upper wall of the Electronic Enclosure. The SYSCON assembly consists of a card cage that houses the SYSCON2 boards, the Ethernet Switch Board, and any other associated hardware such as I/O boards.

Three versions of the SYSCON assembly have been available. The two legacy versions are described in the previous section for the original SYSCON. The newest version is shown in Figure 2-19 below. Users familiar with the original SYSCON will note that the HMI connector is not equipped on the SYSCON assembly shown below. The HMI cables directly to the SIB through an opening in the rear of the SYSCON assembly.

All PC boards in the SYSCON assembly are visible through the front of the drawer for making all I/O connections. Interface connectors to the front panel display, and communication connectors are also located and labeled on the front of the drawer.

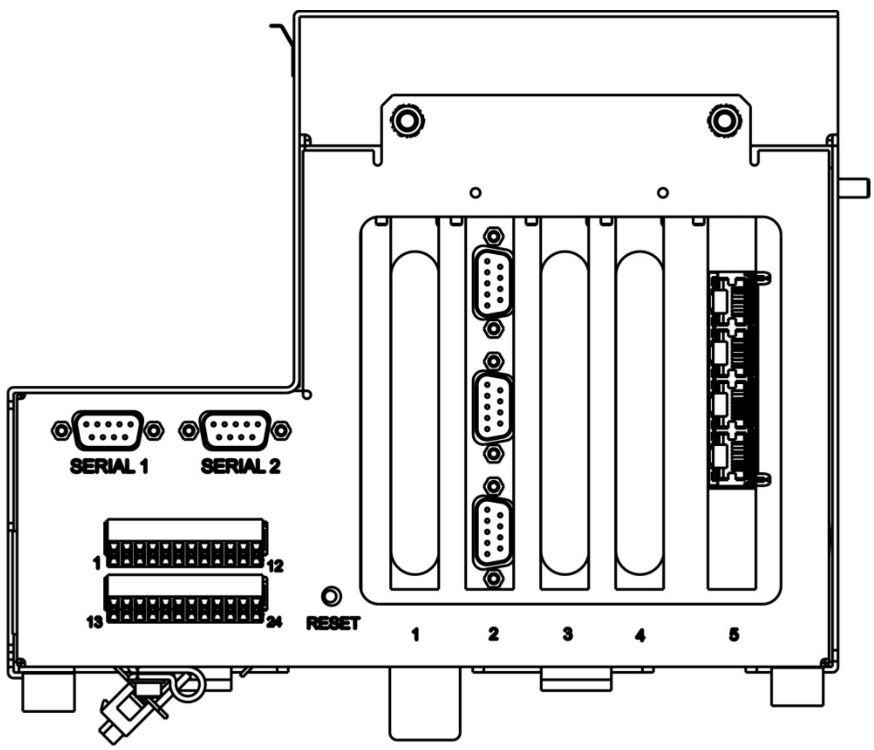


Figure 2-19 SYSCON Assembly for SYSCON2

System Controller Version 2 (SYSCON2), Continued

SYSCON2 Operation

The SYSCON2 contains the application programs and data that are accessible directly or via the external network. The SYSCON2 also contains any MaxBasic programs and the software to run the HMI panel.

All network communications, Maintenance Panel and analyzer functions are coordinated by the SYSCON2. The SYSCON2 does not control sample analysis performed by the Sensor-Near Electronic Module (SNE). The SNE manages and performs all analysis functions independently of the SYSCON.

Communication from the SYSCON2 to other Maxum II modules is functionally the same as for the original SYSCON. Refer back to figures 2-3 and 2-4 for diagrams of internal Maxum communications.

The SYSCON2 communicates with the SNE using a 10BaseT internal Ethernet link. Note that prior versions of SYSCON communicated using a 10Base2 internal Ethernet link.

The SYSCON2 is electrically and mechanically backwards compatible with all prior SYSCON assembly hardware and it is designed to function as a replacement for all prior versions of SYSCON.

While compatible with prior versions of SYSCON, the SYSCON2 provides several important enhancements over the SYSCON, including the following:

- The SYSCON2 operates with a faster processor and higher clock speeds, providing superior performance
- The SYSCON2 provides two on-board I^2C buses. This allows the SYSCON2 to support I^2C functions such as sample system control.
- The SYSCON2 is equipped with four serial ports, each configurable for either RS-232 or RS-485 operation. This compares to a single RS-232 and RS-485 port equipped in the original SYSCON.
- Using the Ethernet Switch Board, four Ethernet connections are available. This allows such advantages as allowing a user to connect a local computer for maintenance purposes without disconnecting the analyzer from the network.
- The Ethernet Switch Board with Fiber eliminates the need for a dedicated fiber optic converter board.

System Controller Version 2 (SYSCON2), Continued

Communication and Control (CAC3) Board

The Communication and Control board (CAC) is a standardized, single-board central processing unit for intended for use in Siemens products`. For the Maxum family of products the third generation of the CAC board (CAC3) is used. See Figure 2-20.

The CAC3 uses a 32-Bit, 240 MHz microprocessor. The on-board memory for the CAC3 consists of 128 MB SDRAM, 64 MB NOR Flash, and 256 MB NAND Flash. The CAC3 also includes an on-board 10/100 Ethernet controller, used for connection to external Ethernet. This is connected via a short RJ-45 patch cable to the Ethernet Switch Board, which resides in a card slot on the SIB.

The communication backbone between the CAC and the SIB is the General Purpose Bus (GP Bus). The GP Bus is a 32 bit, 120 MHz parallel address/data bus with dedicated chip selects and interrupts. In addition to the GP Bus, the CAC communicates via two serial buses. One serial bus is dedicated to the serial debug port. The second serial bus provides four configurable serial communications ports (including Modbus or other basic RS-232/485 protocols). The serial and debug ports are accessed on the front of the SYSCON assembly.

More information and details pertaining to the CAC3 can be found in the System Controller version 2 (SYSCON2) Installation Manual (Siemens part number A5E02643617001).

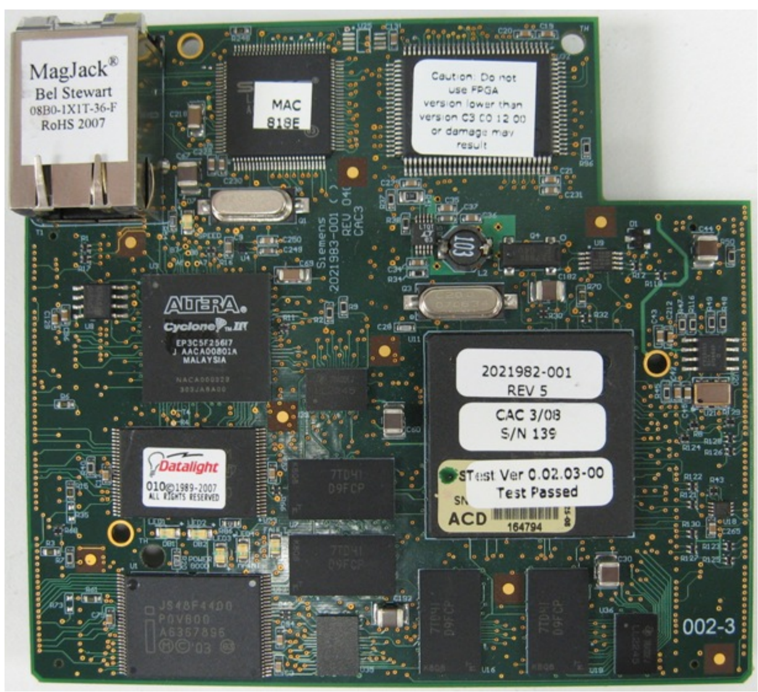


Figure 2-20 CAC3 Board

System Controller Version 2 (SYSCON2), Continued

CAC3 LEDs

The CAC3 is equipped with several LEDs that relate useful information regarding the operating status of the CAC3. These LEDs are shown in Figure 2-21 and described in Table 2-1.

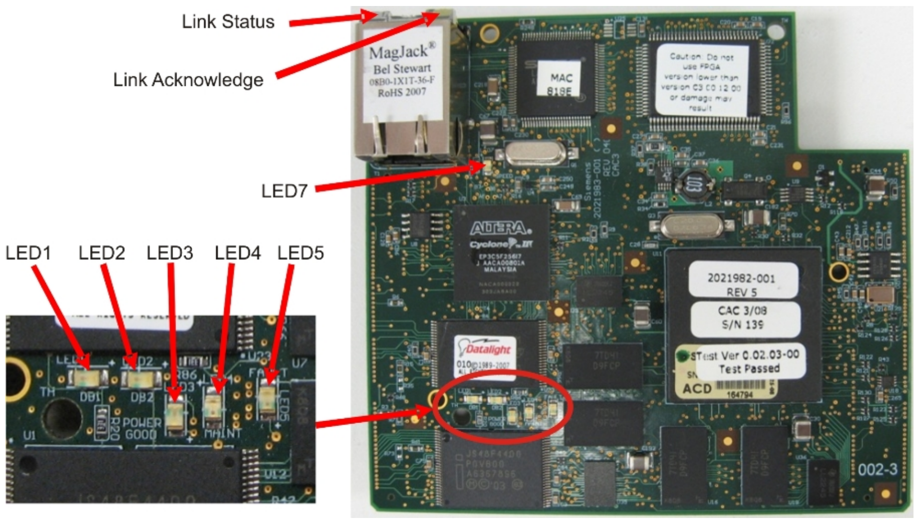


Figure 2-21 LEDs on the CAC3 Board

Table 2-1
CAC3 LEDs

LED1	Debug LED1	Green – On during normal operation.
LED2	Debug LED2	Green – On during normal operation. Off during bootload
LED3	Power Good	Green – Power to CAC3 is functional
LED4	Maintenance	Yellow – Off during normal operation. On during bootload. On – Maintenance fault or bootload
LED5	Fault	Red – CAC3 Board fault
LED7	Ethernet Speed	Green – On – Speed is 100 Mb/sec (or auto-negotiating) Off – Speed is 10 Mb/sec (or disconnected)
Green LED on RJ-45	Link Status	Green – LED is green when link is in full duplex mode.
Yellow LED on RJ-45	Link Acknowledge	Yellow – LED is on when link is active. Will flash off for transmit or receive activity.

System Controller Version 2 (SYSCON2), Continued

SYSCON Interface Board (SIB)

The SYSCON Interface Board (SIB) is a board that, when combined with the CAC3, creates the function of the SYSCON2. Unlike the CAC3, the SIB is specific to the Maxum family of products (including the Maxum, the Maxum II, NAU, and Optichrom Advance Plus). The combined SIB and CAC3 are an electrically and mechanically compatible replacement for the legacy SYSCON board in the Maxum.

Other than external Ethernet, the SIB provides all interfaces for the SYSCON2. The connections are described below. Note that all connectors in the SYSCON2 have the same pin outs as the corresponding connectors in the original SYSCON, except where noted below. Refer to the previous section (legacy SYSCON) for pin outs. Refer to Figure 2-22 and Figure 2-23 for physical connector locations in the SYSCON2:

- PCI and CAN Direct Slots – The PCI slots on the SIB are designed to accommodate a variety of special function cards, including Input/Output boards or ANCB board. Four PCI slots are equipped in the SYSCON2; however, typically only three slots are available for use in the standard configuration. This is because one SYSCON assembly slot is utilized for serial/debug port hardware as shown in Figure 2-23. Only cards specified and sold by Siemens for the SYSCON2 should be installed in the PCI slots of the SYSCON2.

CAUTION

Installation of a card that is not approved by Siemens into a SYSCON2 PCI slot, may damage both the card and the SYSCON2.

In addition to PCI type cards, the card slots are also capable of accommodating Maxum CAN I/O cards. There is a small green connector in line with the PCI slot that allows CAN I/O cards to be inserted in the slot. When a CAN card is installed, the green connector provides the power and CAN signals for the card. The PCI slot connector does not provide any electrical connection for CAN cards.

- Network Expansion Slot – The Ethernet Switch Board (or Ethernet Switch Board with Fiber) plugs into this connector, located on the far right side of the SYSCON2. The connector slot provides power to the Ethernet Switch, but no communication. All communication between the Ethernet Switch and the SYSCON2 is through a short CAT5 Ethernet Cable that connects from the CAC3 to the Ethernet Switch.
- SYSCON Debug – This serial RS-232 port is used to interface to the SYSCON2 debug function on the CAC3. The debug port has no support for hardware handshake. The debug port is accessed via a DB9 connector on the front of the SYSCON assembly cage.

System Controller Version 2 (SYSCON2), Continued

SYSCON Interface Board (SIB), continued

- Serial Ports 1 and 2 – The SYSCON2 is equipped with two serial ports, each ground isolated and configurable for RS-232 or RS-485. Both ports support RTS/CTS hardware handshake. Maximum supported data rate on the serial ports is 115200 bits/second. Serial Port 1 is used to support Modbus and Serial Port 2 may be used to support a printer.

CAUTION

Installation of a card that is not approved by Siemens into a SYSCON2 PCI slot, may damage both the card and the SYSCON2.

Note: When configured for RS-485 operation, the serial ports are designed to comply with the Profibus standard. This results in a different pinout than for the previous version of SYSCON (pins 8 and 2 reversed). For backward Modbus RS-485 compatibility when replacing a SYSCON+ with a SYSCON2, an adapter cable (part number A5E02283873001) is available.

DB-9 Pin#	RS-232	RS-485 Modbus
1	-	-
2	RX	5 V Pwr
3	TX	Line B (RxD+/TxD+)
4	-	-
5	GND	Common
6	-	-
7	RTS	-
8	CTS	Line A (RxD–/TxD–)
9	-	-

- Serial Ports 3 and 4 – These two serial ports, equipped on the same slot connector as the SYSCON Debug port, are planned for future expansion and are not active in software release 5.0.
- I^2C Bus – The I^2C connectors are shown in the upper right corner of Figure 2-22. Two I^2C buses are equipped on the SYSCON2. These are labeled I^2C Bus A and I^2C Bus B.
  - I^2C Bus A includes the two connectors on the right as shown in Figure 2-22. I^2C Bus A is dedicated and hard wired to the CAN Bridge function. This allows the new SYSCON2 to interface with legacy CAN I/O cards in the PCI slots.
  - I^2C Bus B includes the three I^2C connectors on the left as shown in Figure 2-22. I^2C Bus B is intended for use to support future configuration changes in the Maxum II.
- Analog and Digital Inputs/Outputs – The SYSCON2 allows for the configuration of up to ten on-board inputs/outputs. The connectors for these are wired from two orange connectors on the front of the SYSCON assembly cage.

System Controller Version 2 (SYSCON2), Continued

SYSCON Interface Board (SIB), continued

- Interface to External CAN Bus (for CEU) – This connector on the SYSCON2 is provided to allow support for the CAN Extension Unit (CEU)
- Internal CAN Bus Interface – This connector is used for extension of the internal CAN bus to allow for additional CAN I/O cards. It is only used when the SYSCON2 is installed in an NAU.
- Resets – The SYSCON2 is equipped with two connections for SYSCON reset. The first connection, located at the front of the board (bottom of Figure 2-22), is a pushbutton switch. This switch may be accessed via the front of the newest version SYSCON assembly cage as seen in Figure 2-23. The second connection consists of two pin connections at the back of the board (top left of Figure 2-22). This second connection operates using a simple loop closure and is provided to support legacy SYSCON assembly cages that provide a separate wired pushbutton reset. Both connections allow the user to initiate a hard reset of the SYSCON (same as initial power up).
- Purge – The purge detect circuit for the SYSCON2 works in the same manner as for the SYSCON1. The purge detect signal is received from the PECM and distributed to the HMI (purge fault LED) and handled by the SYSCON as a digital input to generate a purge alarm.
- Interface to HMI Hardware – The HMI panel connects to the SYSCON2 using a parallel bus over a physical ribbon cable. This bus operates at 33 MHz to support the existing HMI hardware; however, future HMI hardware may utilize the faster bus speeds that the SYSCON2 can provide. Note that the connector used on the SYSCON2 is physically different than for SYSCON1 (although the pin out of the ribbon cable is the same). The HMI cable runs directly from the SIB to the HMI panel.
- USB Ports – The SYSCON2 hardware is equipped with three USB ports. However, these ports are planned for future use and are not currently functional.
- Power – The source of power for the SYSCON2 is the 24 V power supply equipped in the Maxum analyzer. The SYSCON2 is equipped with on-board power conversion to derive the other voltages needed for operation (3.3 V, 5 V, and 12 V). The primary operating voltage of the SYSCON2 is 3.3 V.
- Battery – The SYSCON2 is equipped with a long-life 3 V battery backup to support the real time clock on the CAC3 board. This battery should last at least 5 years under normal operation. Note that the battery is located on the SIB board while the real time clock is on the CAC3 board. If the CAC3 board is disconnected from the SIB, then battery backup is lost. This will affect the time and date on the analyzer.

System Controller Version 2 (SYSCON2), Continued

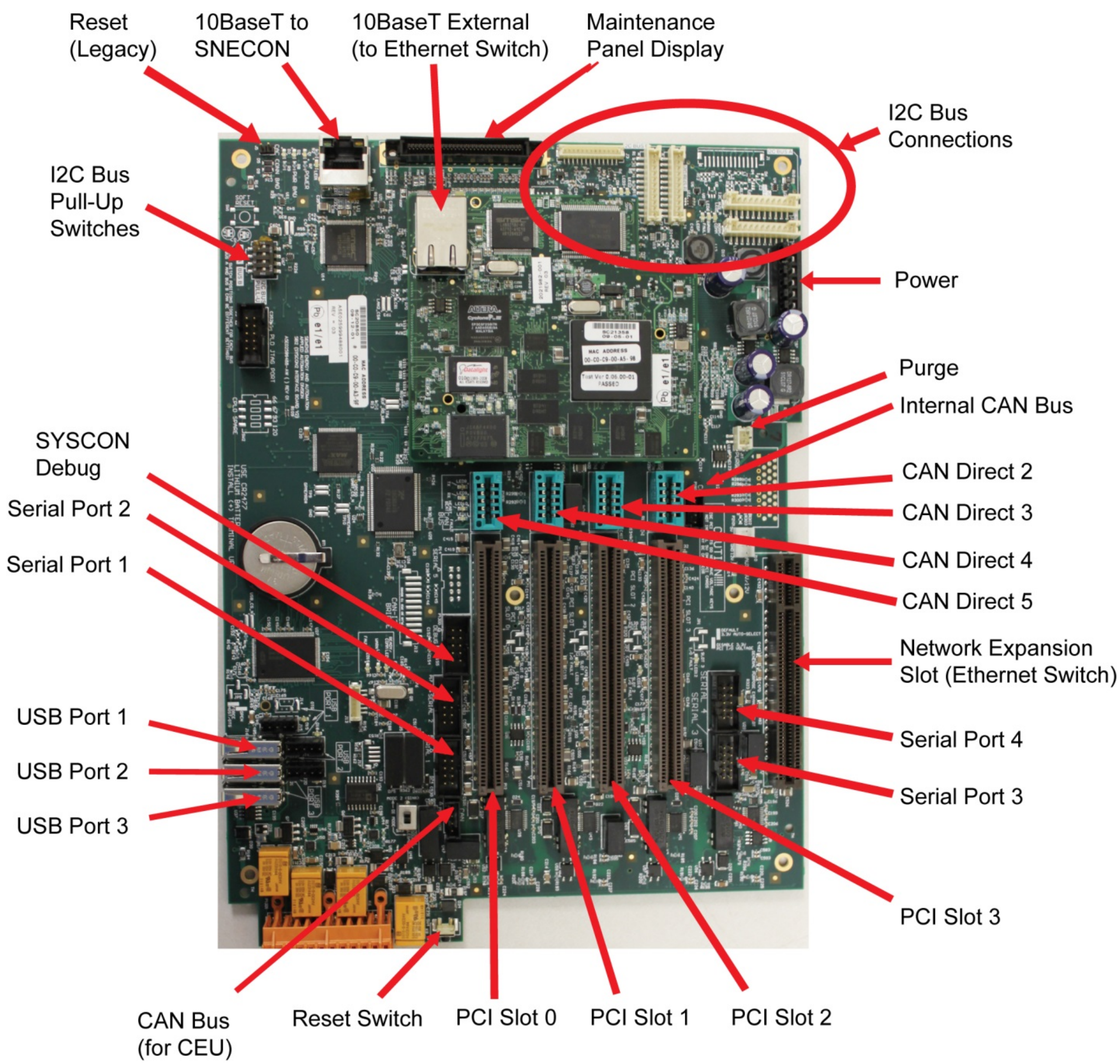


Figure 2-22 SYSCON2 Connections

System Controller Version 2 (SYSCON2), Continued

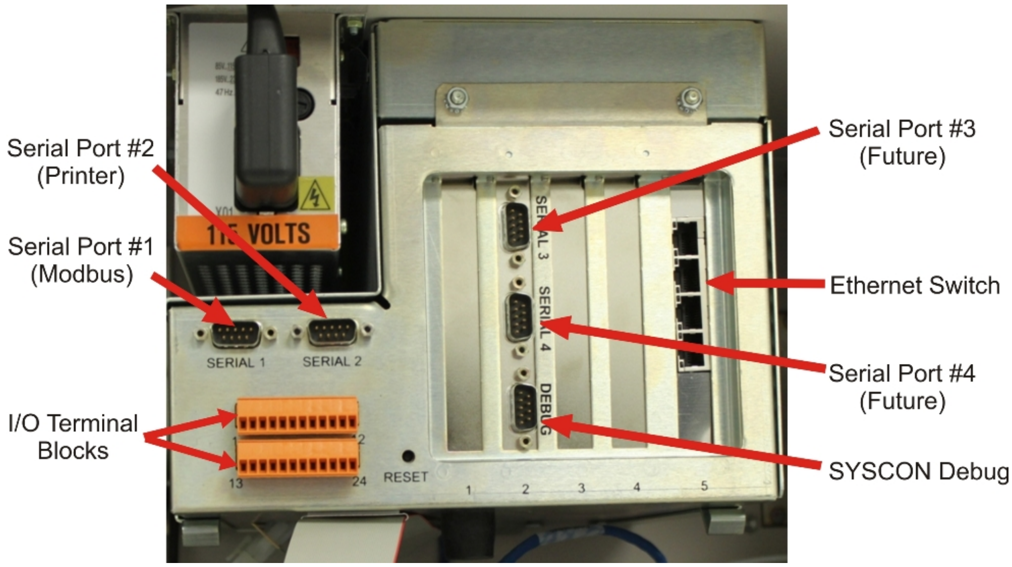


Figure 2-23 SYSCON2 Assembly Front Connections

System Controller Version 2 (SYSCON2), Continued

SIB LEDs and Options

The SIB is equipped with several LEDs that relate useful information regarding the operating status different interfaces. These LEDs are shown in Figure 2-31 and described in Table 2-2. The SIB is also equipped with certain option switches, described below, that must be set appropriately for proper operation. Before installation, verify that all switches are set correctly. When replacing a SYSCON2 verify that the switch settings on the new board match the switch settings on the board being removed.

- DI Mode Switch – Switch SW3 located near the orange I/O connectors controls the mode setting for the on-board digital inputs. The available options are Mode 1 (source) and Mode 2 (sink). This switch should be set to Mode 2 regardless of the configuration unless instructed differently by Siemens.
- Reset Switch – The function of the reset switch is described in the SIB connector description section.
- I^2C Bus Pull-Up DIP Switches – These switches are set to OFF for a particular SYSCON I^2C Bus when that bus is connected directly to a Wiring Distribution Board (WDB). This is a non-standard configuration as WDBs are generally connected to the SNECON. There is one set of two switches for I^2C Bus A and another set for I^2C Bus B (as marked on the board). Both switches for a particular bus must be set the same.
  Note: When the WDB is connected to the SNECON, (the standard configuration) ALL four I^2C Bus Pull-Up DIP Switches must be set to ON.
- I^2C Bus A Settings – When using the embedded SNE in place of the external SNE, a cable connects one of the two terminals for I^2C Bus A to the WDB. When using this configuration, turn off both switches for I^2C Bus A.
- I^2C Bus B Settings – When using the SSSI, turn off both switches for I^2C Bus B. When the SSSI is not being used, turn both switches on.

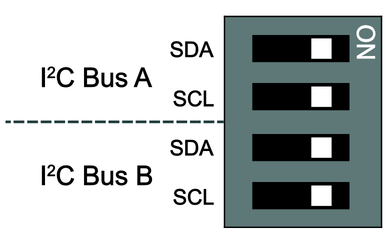


Figure 2-24 SIB LED and Switch Locations

System Controller Version 2 (SYSCON2), Continued

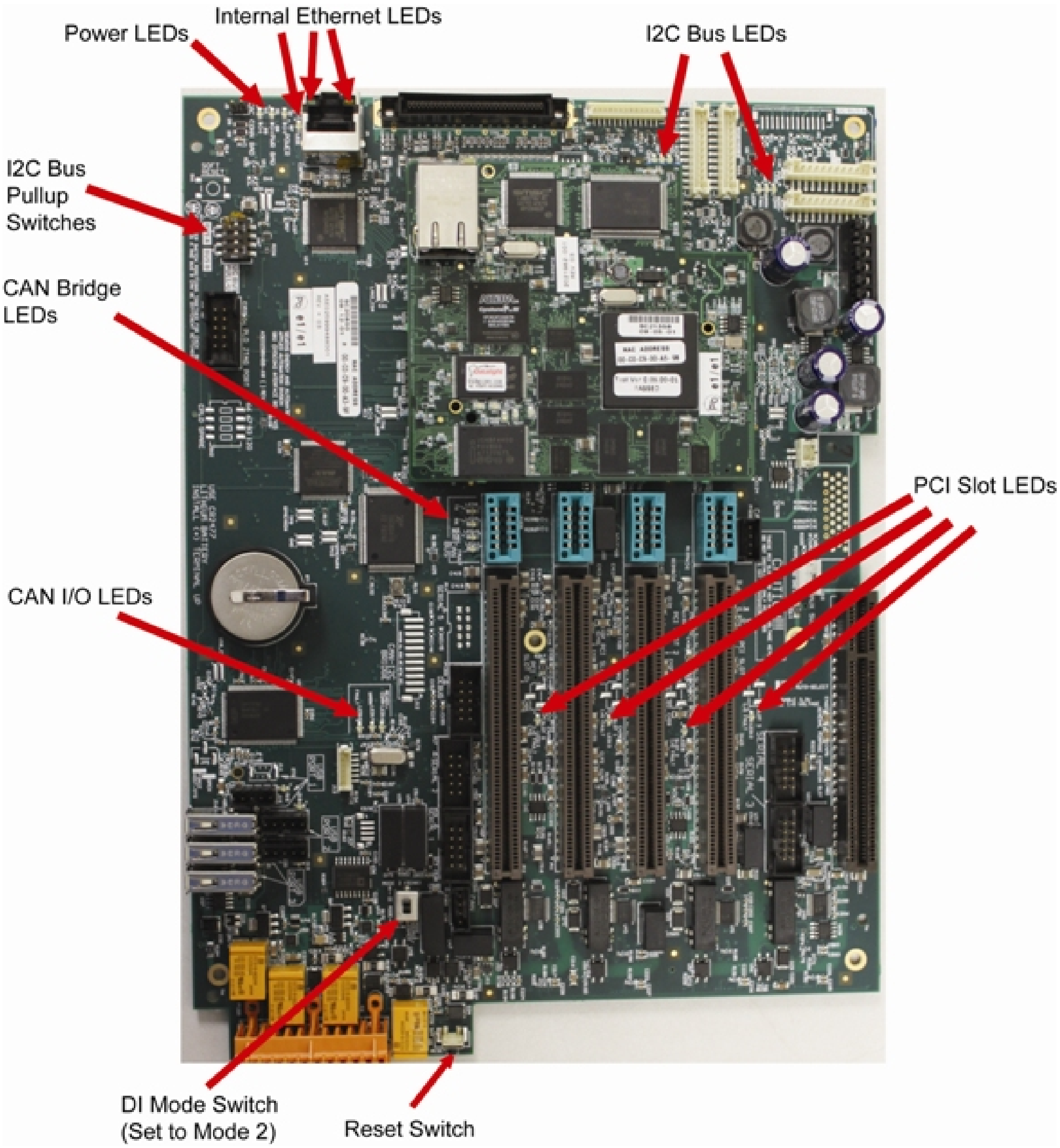


Figure 2-25 SIB LED and Switch Locations

System Controller Version 2 (SYSCON2), Continued

Table 2-2
SIB LEDs

LED Type	Description	Color / Meaning
Power *(Located at the back of the board near the RJ-45 connector)*	Power	Green – 3.3V power is available. Should be on at all times
	Power Bad	Red – Power is faulty or SYSCON hardware reset switch is being pressed
	CAC Conn Bad	Red – Connection from the SIB to the CAC3 is faulty or incomplete. After power up, this LED should turn off once CAC3 to SIB connection is completely initialized.
I^2C Bus LEDs Buses A and B *(Located next to I^2C Bus connectors)*	LED2/5 Norm/Comm	Dim Green – I^2C Bus is normal. Bright Green - I^2C Bus is communicating
	LED3/6 Warning	Yellow – Warning on the I^2C Bus
	LED4/7 Fault	Red –I^2C Bus fault
CAN Bridge LEDs *(Located to the left of the far left PCI slot)*	LED16 Ready/Comm	Dim Green – CAN Bridge is normal Bright Green – CAN Bridge is communicating
	LED17 Warning	Yellow – Warning on the CAN bridge
	LED15 Fault	Red – CAN Bridge fault
CAN I/O LEDs *(Located next to far left CAN direct connector, CAN direct 5)*	LED8 TX	Green – On when a valid CAN I/O message (other than a heartbeat reply) has been received and queued for processing
	LED9 RX	Green – On when a CAN message (other than a heartbeat transmission) has been queued for sending to the CAN hardware
	LED10 Heartbeat	Green – Flashes once for each heartbeat message transmitted. This LED will flash once every 1.5 seconds for each active CAN card
	LED11 Fault	Red – On when an error state is detected on the CAN bus hardware

System Controller Version 2 (SYSCON2), Continued

PCI Slot LEDs *(Located between PCI slots)*	LED14 Slot 0 Fault	Red – Overcurrent or thermal shutdown on PCI slot 0.
	LED13 Slot 1 Fault	Red – Overcurrent or thermal shutdown on PCI slot 1.
	LED18 Slot 2 Fault	Red – Overcurrent or thermal shutdown on PCI slot 2.
	LED12 Slot 3 Fault	Red – Overcurrent or thermal shutdown on PCI slot 3.
Internal Ethernet LED's *(located next to and on SIB RJ-45 connector)*	Green LED on RJ-45	Green – LED is green when link is in full duplex mode.
	Yellow LED on RJ-45	Yellow – LED is on when link is active. Will flash off for transmit or receive activity.
	LED1 Speed	Green – On – Speed is 100 Mb/sec (or auto-negotiating) Off – Speed is 10 Mb/sec (or disconnected)
Note: Refer to figure 2-20 for physical locations of SIB LED's		

I/O Slot Assignments

If expansion boards are added to the SIB of the SYSCON2, they must be installed in the following slots. These slots are numbered from left to right when viewing the SYSCON2 from the front.

- Advance Network Communication Board (ANCB) for Advance Data Highway (ADH) – Slot 1
- No board is installed in slot 2. This slot provides the connectors for external debugging and for serial ports 3 and 4.
- Analog and Digital I/O boards (CAN or I^2C)– Slots 1, 3, or 4 (only 2 may be used at a time)
- Ethernet Switch Board (ESB) or Ethernet Switch Board with Fiber (ESBF) for external Ethernet – Slot 5
- Optional Expansion Ethernet Switch Board with Fiber – Slots 1, 3, or 4

All network communications, Maintenance Panel and analyzer functions are coordinated by the SYSCON2. The SYSCON2 does not control sample analysis performed by the Sensor-Near Electronic Module (SNE). The SNE manages and performs all analysis functions independently of the SYSCON.

Multiple SNE Configurations

Note: This section is applicable only to configurations where more than one SNE board is equipped in the Maxum. If only one SNE is equipped, then the SYSCON2 cables directly from SIB to SNE using a standard CAT5 Ethernet cable.

The legacy SYSCON was designed to support hardware configurations with more than one SNE by using a “daisy-chain” configuration from SNE to SNE. That daisy chain configuration is described as part of the Sensor Near Electronics description later in this chapter. Because the SYSCON2 communicates to installed SNE hardware using 10BaseT Ethernet, of which each SNE has only one connector, the daisy-chain configuration is not possible.

In cases where a SYSCON2 is required to communicate with multiple SNE boards, an ESBF is used as shown in Figure 2-29 below. The ESBF plugs into a free PCI slot and is used to switch the 10BaseT Ethernet to as many as three SNE boards.

Note that in this configuration ONLY an ESBF may be used. This is required because only the ESBF is capable of operating in a PCI slot. Note also that the network slot (slot 5) may not be used for multiple SNE communications since an ESB or ESBF is required in the network slot and is connected to the CAC3 for external Ethernet communication.

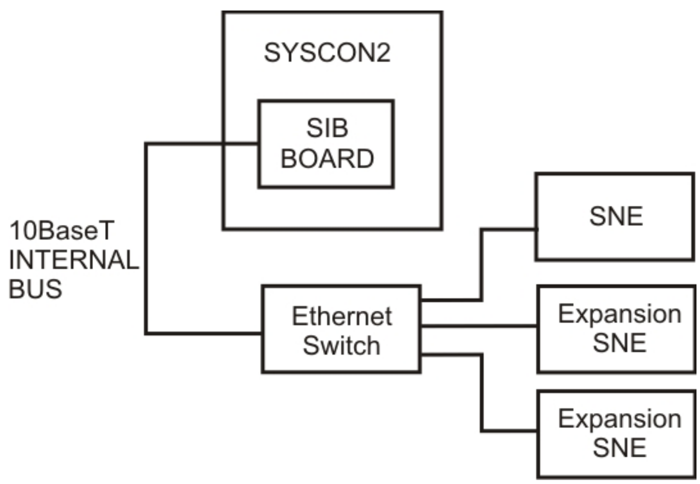


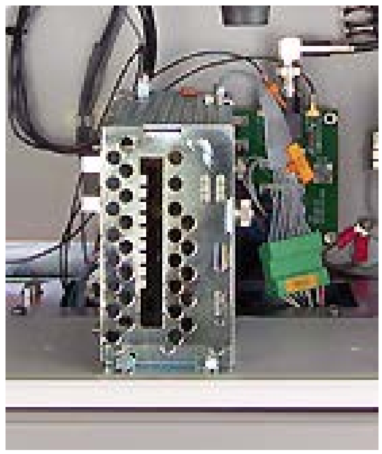
Figure 2-26 Connecting Multiple SNEs Using The ESBF

Sensor Near Electronics (SNE) (Legacy Systems)

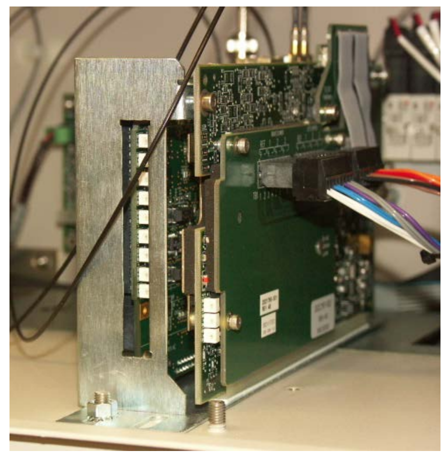
Description

The Sensor Near Electronics (SNE) contains all the application programs required to perform a sample analysis. The SNE controls the sample analysis, acquires and processes data from detectors and controls and monitors the analytical operating environment. A total of up to three SNEs can be installed within the electronic enclosure. See Figure 2-30.

More information and details pertaining to the SNE can be found in the Sensor Near Electronics (SNE) Assembly Installation Manual (Siemens part number 2000685-001).



Original Housing



New Housing

Figure 2-27 Sensor Near Electronics (SNE) Assembly

Mechanical

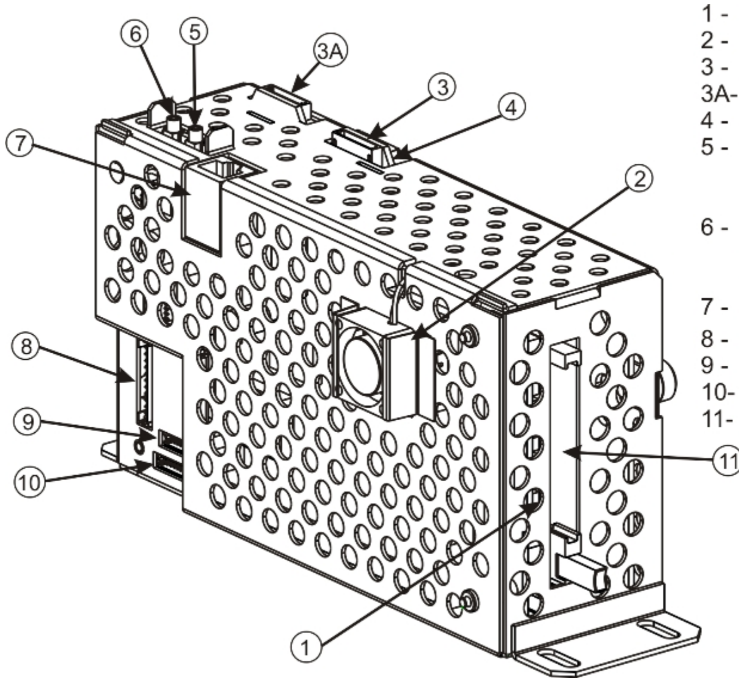
The SNE is located in a protective housing in the Electronic Enclosure (EC). The housing can be the original closed metal cage or the open cage that is the current version of the housing. See Figure 2-30.

Original Housing

The original housing is a perforated cover that allows cooling air to enter and flow around the installed SNE boards. For added ventilation, a cooling fan is mounted between two spring clips on the side of the SNE. Operational LEDs are visible through a cutout in the cover. An easily removed side cover allows access to the expansion slots. A restriction for the original enclosure is that some of the FID detector personality modules will not fit into the cage; in the cases where these are used, the user will need to upgrade to the current version of the housing.

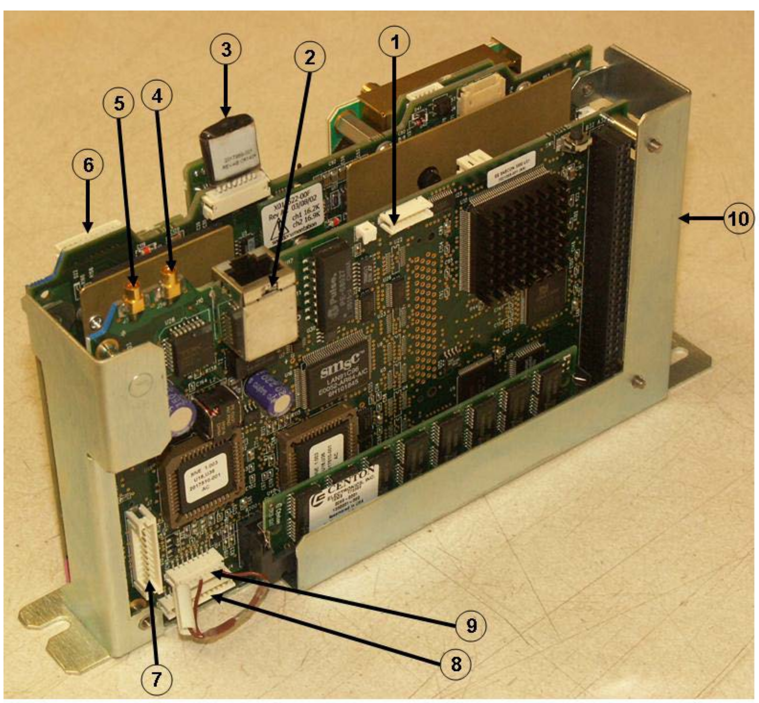
New Housing

The new housing has an open architecture. Because of this there is no cooling fan on the housing. Also, the housing is able to accommodate all detector personality module types. Operational LEDs are visible through a cutout in the cover.



1 - Status LEDS
2 - Cooling Fan
3 - To Oven Heater 2
3A- To Oven Heater 1
4 - DPM Signal todetector
5 - J50 to Wiring Distribution Board or for Daisy Chaining SNE (legacy SYSCON)
6 - J5 to Wiring Disrtibution Board or for Terminating Daisy Chaining (legacy SYSCON)
7 - J10 to SYSCON2 (SIB)
8 - J7 I^2C Bus Connection
9 - J14 Module ID Connector
10- J4 Debug Connector
11- not used

Figure 2-28 SNE Module Connectors (Original Housing)



1. J9 – Not Used
2. J10 – To SYSCON2 (SIB)
3. To Oven Heater 1
4. J50 – To WDB (legacy SYSCON)
5. J5 – To WDB (legacy SYSCON)
6. To Oven Heater 2
7. J7 – I^2C Bus
8. J4 – SNE Debug
9. J14 – SNE ID
10. Status LEDs

Figure 2-29 Figure 2-27: SNE Module Connectors (New Housing)

Electrical

The SNE houses the SNE Controller board and the Detector Personality Module. As an alternative, the SNE can house a Temperature Controller Board that provides two additional temperature controller channels in addition to the two provided for on the SNE Controller board; see Figure 2-33 through Figure 2-35.

SNE Controller Board

The SNECON is a 486 Processor CPU running on the pSOS+ operating system with 4 to 16 Mbytes of RAM. The CPU manages and controls all chromatography functions to perform the compositional analysis of the input stream. The SNECON communicates to the internal hardware circuits via I^2C internal bus. The SNECON transmits finished analysis results and alarm information to the SYSCON. The analysis data is then routed either to the maintenance panel for display, to the PC Workstation, to DSS system or to any other output devices. The SNECON also contains circuits to control and monitor the analytical operating environment via the electronic pressure and control sensors, barometric pressure sensors, flow sensors, or temperature control sensors. The SNECON also controls the 24-V solenoid valve drivers and high-voltage power switching circuits (heaters, solenoids, etc.) as needed.

Status LEDs visible on the front of the SNE indicate the operational status of Maxum II Gas Chromatograph; see SNE Status LED meanings in Table 2-4 later in this section.

At least one SNECON module is required in the Maxum II. The Maxum GC may have from one to three SNE assemblies – corresponding to the possibility of one to three detector assemblies in the chromatograph oven. It is possible to put a SNECON into each of the three SNEs. This may be required in certain very stringent application situations such as a large number of detectors operating at very fast detector scan rates. However, multiple SNECONs are very rarely used. The SNECON module can handle a combined sampling rate of over 200 points per second. This means that a single SNECON can easily accommodate a Maxum oven loaded with up to eighteen Thermistor Detectors scanning at up to ten points per second (for a combined scan rate of 180 points per second). Or, it can accommodate fewer detectors scanning at much higher scan rates.

Detector Personality Module

The DPM contains all signal processing circuitry to decode and digitize the analysis signal from the detector. There are a variety of DPM types depending on detector type; see Figure 2-30 and Figure 2-32.

- Controls oven heating requirements
- Regulates analysis cycle timed events
- Digitizes detector signal

More Information

For more information see Detector Personality Module (DPM), page 2-**Error! Bookmark not defined.**.

SNECON Software

The SNECON operates as a set of intercommunicating tasks running on the pSOS+ operating system. The SNECON is configured by the System Controller (SYSCON), connected via one of its communication links. Once the system is configured, the SNE can run independently and periodically report analysis results. The major SNE software components are as follows:

- Data Manager
- Communications Manager
- Hardware Manager
- Computational Engine EZChrom ™
- Gates and integrates peak areas
- Calculates compositional data

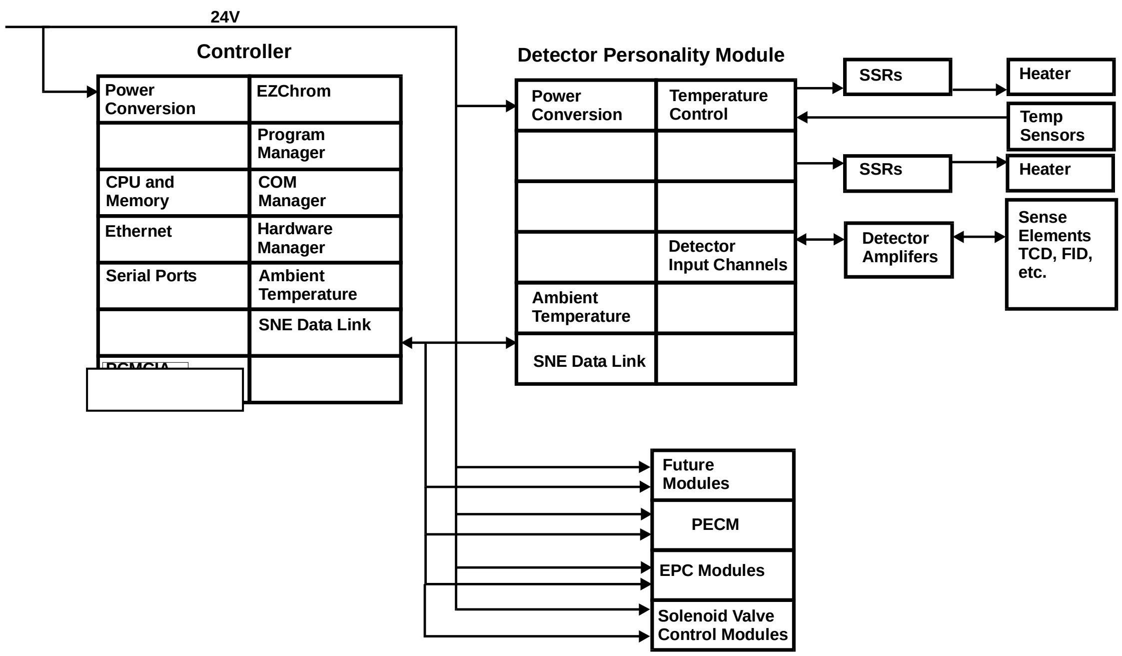


Figure 2-30 SNE Functional Block Diagram

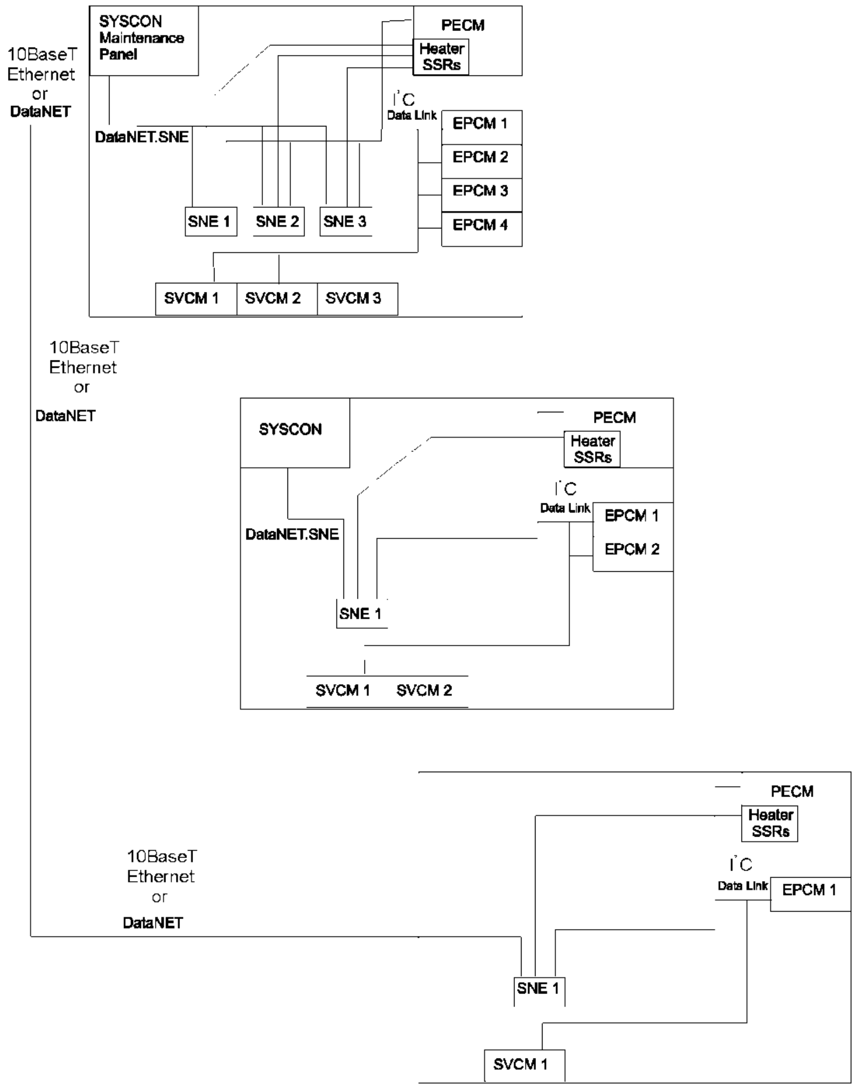


Figure 2-31 SNE Module Connections - Example Configuration

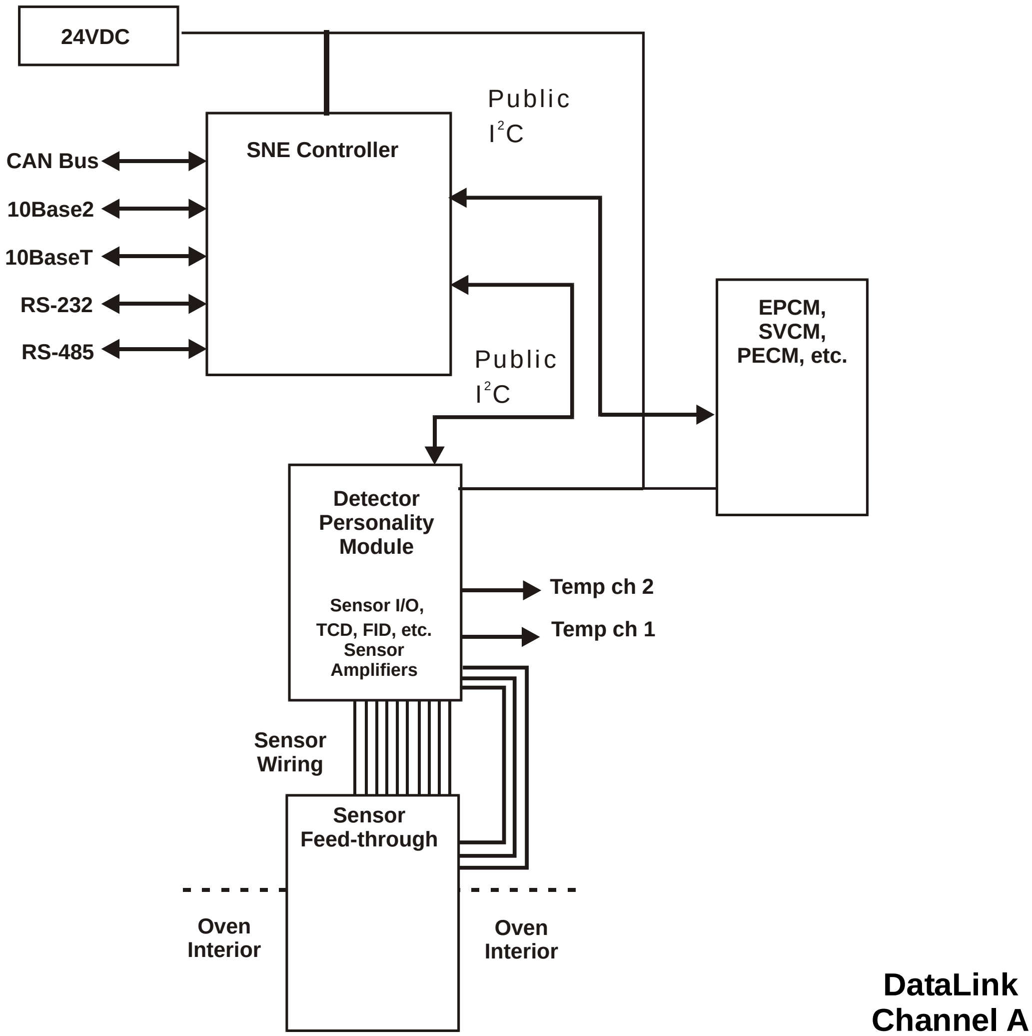


Figure 2-32 SNE Interface Diagram

Daisy Chaining

When legacy SYSCON is used, all SNECONs equipped in the analyzer must be daisy chained together via the Internal Ethernet bus. Up to 3 SNECONs can be daisy chained together within a single enclosure; see "Daisy Chaining SNEs (Applicable to Legacy SYSCON Only)" on page 2-**Error! Bookmark not defined.**. Note that the daisy chain configuration is not used for SYSCON2.

Connectors

The SNECON has 2 miniature coax connectors on the top of the SNE, see Figure 2-31 and Figure 2-32. These connectors are 10Base2 and are utilized ONLY if legacy SYSCON is installed. In SYSCON2 connector J10 (RJ-45) is used instead. The mini-coax connectors (J5 & J50) are interchangeable. One of these connectors will connect to one of the two mini-coax Ethernet connectors on the Wiring Distribution Board (WDB). If only one SNE is used, the second connector on the SNE simply returns and plugs into the second connector on the WDB. If more than one SNE is equipped in a GC, these SNEs must be daisy chained together using the second mini-coax connector. The end of the daisy chain will return to the WDB; refer to Figure 2-51 in the WDB section of this chapter.

In a newer version of Wiring Distribution Board, called WDB+T, the miniature Coax connectors are replaced by RJ45 Ethernet connectors. These connections are 10BaseT. The design of the WDB+T allows the use of the RJ45 connector on the SNECON (J10). The miniature coax connectors will be phased out. The J10 connector is also used when the SYSCON2 is installed. In this situation, the RJ-45 on the SIB of the SYSCON2 cables directly to the SNECON J10 connector as described in the SYSCON2 section of this chapter.

The internal bus connector J7 is located on the lower left of the SNE near the back of the module. The internal bus plugs in here and terminates at the Wiring Distribution Board (WDB).

The ID Key connector J14 is located on the lower left of the SNE near the back of the module. Since multiple SNEs can be located into one Maxum II, it is necessary to identify the individual SNEs. This is done by installing an identification plug on the SNECON at the connector labeled J14. This will be pre-configured at the factory.

The Debug connector J4 is located lower left of the SNE near the back of the module. **Note:** This connection is for use only by trained Siemens factory technicians.

Status Lights

These status lights indicate the operational status of Maxum II Gas Chromatograph. Status lights are referenced from LED 1 to LED 9 from top to bottom of board; see Figure 2-36.

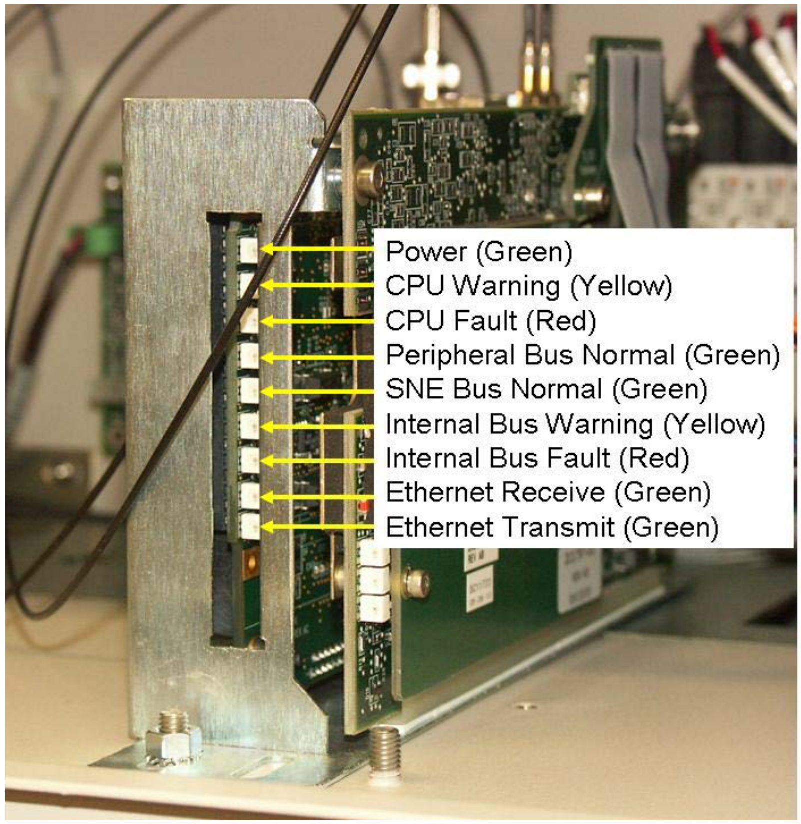


Figure 2-33 SNE Status Lights

Table 2-3
SNE Functional Status Lights

LED 1	Green	"NORMAL" - Power OK to SNECON
LED 2	Yellow	"WARNING" - SNE CPU Warning
LED 3	Red	"FAULT" - SNE CPU Fault
LED 4	Green	"PERIPHERAL Internal Bus (I^2C) PIC NORMAL"
LED 5	Green	"SNE Internal Bus (I^2C) PIC NORMAL"
LED 6	Yellow	Internal Bus (I^2C) WARNING
LED 7	Red	Internal Bus (I^2C) Fault
LED 8	Green	Ethernet Receive
LED 9	Green	Ethernet Transmit

Appendix B

Acronyms

AD-4	Analog/Digital Input and Output Board
ANCB	Advance Network Communications Board; Connects Ethernet or DataNet to Advance Data Hiway Communication
ANG	Advance Network Gateway; connects high- and low-speed networks
AO-8	Analog Output Board
CAC3	Communication and Analytical Control board Version 3 (processor board of SYSCON2, mounts on SIB)
CEU	CAN Extension Unit; used to house additional input and output boards
CIM	Control Interface Module
CTB	Color Touchscreen Display
DIO-4	Digital Input and Output Board
DNH	DataNET Hub; connects multiple DataNET segments together
DPM	Detector Personality Module; amplifies and digitizes detector signals
EC	Electronics Enclosure
EPCM	Electronic Pressure Control Module
FD	Filament Detector
FID	Flame Ionization Detector
FPD	Flame Photometric Detector
GC	Gas Chromatograph
HMI (MMI)	Human to Machine Interface
NAU	Network Access Unit
OEFT	Oven Entry Feed Through; linkage between SNE and detector
PCM	Purge Control Module; allows entry of purge air to electronics enclosure
PDD	Pulsed Discharge Detector
PECM	Power Entry and Control Module
SIB	SYSCON Interface Board (base motherboard of SYSCON2).
SNE	Sensor Near Electronics; controller attached to oven detectors
SNECON	SNE Controller Board; processor board inside SNE enclosure
SVCM	Solenoid Valve Control Module
SYSCON	System Controller; main control computer board in GC and NAU. May refer to either legacy SYSCON or SYSCON2.
TCD	Thermal Conductivity Detector
TIB	Touch Interface Board
WDB	Wiring Distribution Board; distributes cable harness inside GC electronics

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