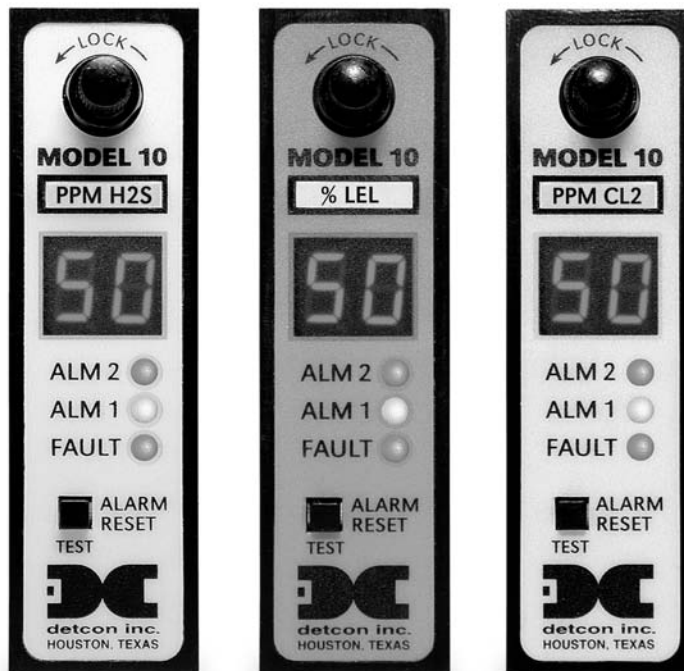




# Detcon Model 10

Single Channel Digital Control Module



## *Operator's Installation & Instruction Manual*

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## 2.0 DESCRIPTION

Detcon Model 10 single channel digital control modules are designed to supervise and display the status of a single remote gas sensor assembly. Modules are available for a variety of toxic and combustible gases. Model 10 Series control modules are designed to operate on an input voltage of 24 VDC and are compatible with a complete line of Detcon enclosures and mainframe hardware assemblies. The available enclosures include designs for rack or panel mounting in non-hazardous areas (NEMA 1), for weather proof outdoor location in non-hazardous areas (NEMA 4), and for location in areas electrically classified hazardous or explosion proof (NEMA 7).

Any combination of Model 10 control modules and Detcon gas sensor assemblies may be installed in a common mainframe assembly thereby providing monitoring for a variety of gases. Model 10 control modules are compatible with a linear 4-20 mA DC input signal. The module features a direct reading 2 or 3 digit display of the gas concentration, flashing overrange, RS-485 Modbus™ serial output, 4-20 mA analog signal output, and three alarm relays that are status displayed via light emitting diodes located on the front panel. Alarm functions are alarm 1, alarm 2, and fault. All alarms are switch programmable for latching or non-latching operation with a common front panel reset switch. The reset is part of a common bus when installed in a mainframe, allowing for the use of an external reset switch common to all modules in the mainframe.



Two or three digit indicator serves as both a power on indicator and a direct reading display of the gas concentration. The display will also flash on and off during any overrange condition.

Alarm set points — alarm 1 and alarm 2 — are menu/software adjustable in 1 ppm/% increments between 10% & 90% of full scale range. Programmable switches allow for several user selectable alarm options.

The fault alarm, depending on the switch programmable configuration, will activate on loss of power, internal power supply fault, open circuit in field wiring, open heater/bridge in sensor, or during an alarm disable condition.

The alarm reset switch resets alarms that have been programmed latching. It also acts as a menu interface switch to activate the program menu system and microprocessor supervised test functions.

## 2.1 SPECIFICATIONS

### Range

Software selectable between 0-5 ppm/% and 0-999 ppm/% in increments of 5 ppm/%

### Accuracy/Repeatability

± 2% F.S.

### Operating Temperature

-40° F to +175° F

### Input Power

24 VDC standard; 12 VDC optional

### Power Consumption (per channel)

Normal: 0.8 watts\*

Full Alarm: 1.7 watts\*

\*Control module only. See sensor product literature for power per sensor.

## Warranty

One year

Five year fixed fee service policy

## Outputs

Analog 4-20 mA DC

Serial RS-485 Modbus™

## Relays

Contacts include common, normally open, and normally closed for three alarms

Resistive load: 5A, 250 VAC; 5A, 30 VDC

Inductive load: 2A, 250 VAC; 2A, 30 VDC

Max. operating current: 5A

## 2.2 CONTROLLER MODELS

The table below provides a list of model numbers of the Series 10 Controller, the target gas and gas formula, and the standard range for that gas. A particular Series 10 Control Module may be programmed for a different range than standard. For more information on possible ranges see section 2.4.3. To determine the range setting of a particular control module reference section 2.4.2.

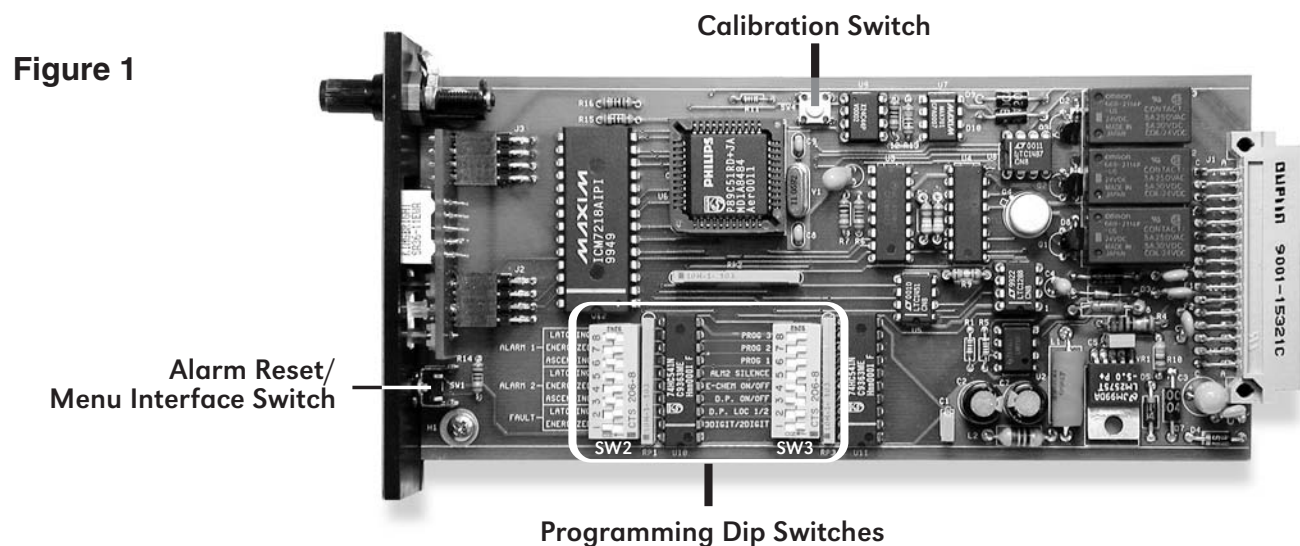
The label on the Model 10 face plate follows a standard color scheme for identifying the gas type: Yellow = Solid State H<sub>2</sub>S, Orange = Combustible Gas, Green = Oxygen, and Blue = Electrochemical Toxic (various). The gas identifier label on the face plate also shows the gas formula and range of detection (ppm/ppb/% etc).

Model #	Standard Range	Target Gas	Formula
CG-10	0-100 % LEL	Combustible Gases	various
HS-10	0-100 PPM	Hydrogen Sulfide	H <sub>2</sub> S
O <sub>2</sub> -10	0-25 %	Oxygen	O <sub>2</sub>
C <sub>2</sub> H <sub>3</sub> O-10	0-100 PPM	Acetaldehyde	C <sub>2</sub> H <sub>3</sub> O
C <sub>2</sub> H <sub>2</sub> -10	0-100 PPM	Acetylene	C <sub>2</sub> H <sub>2</sub>
C <sub>3</sub> H <sub>3</sub> N-10	0-100 PPM	Acrylonitrile	C <sub>3</sub> H <sub>3</sub> N
NH <sub>3</sub> -10	0-100 PPM	Ammonia	NH <sub>3</sub>
AsH <sub>3</sub> -10	0-1 PPM	Arsine	AsH <sub>3</sub>
Br <sub>2</sub> -10	0-5 PPM	Bromine	Br <sub>2</sub>
C <sub>4</sub> H <sub>6</sub> -10	0-100 PPM	Butadiene	C <sub>4</sub> H <sub>6</sub>
CO <sub>2</sub> -12	0-1 %	Carbon Dioxide	CO <sub>2</sub>
CS <sub>2</sub> -10	0-100 PPM	Carbon Disulfide	CS <sub>2</sub>
CS-10	0-100 PPM	Carbonyl Sulfide	CS
CO-10	0-100 PPM	Carbon Monoxide	CO
CL <sub>2</sub> -10	0-10 PPM	Chlorine	CL <sub>2</sub>
CLO <sub>2</sub> -10	0-1 PPM	Chlorine Dioxide	CLO <sub>2</sub>
B <sub>2</sub> H <sub>6</sub> -10	0-5 PPM	Diborane	B <sub>2</sub> H <sub>6</sub>
C <sub>2</sub> H <sub>6</sub> S-10	0-100 PPM	Dimethyl Sulfide	C <sub>2</sub> H <sub>6</sub> S
C <sub>3</sub> H <sub>5</sub> OCL-10	0-10 PPM	Epichlorohydrin	C <sub>3</sub> H <sub>5</sub> OCL
C <sub>2</sub> H <sub>5</sub> OH-10	0-100 PPM	Ethanol	C <sub>2</sub> H <sub>5</sub> OH
C <sub>2</sub> H <sub>4</sub> -10	0-100 PPM	Ethylene	C <sub>2</sub> H <sub>4</sub>
C <sub>2</sub> H <sub>4</sub> O-10	0-100 PPM	Ethylene Oxide	C <sub>2</sub> H <sub>4</sub> O
F <sub>2</sub> -10	0-1 PPM	Fluorine	F <sub>2</sub>
CH <sub>2</sub> O-10	0-100 PPM	Formaldehyde	CH <sub>2</sub> O
GeH <sub>4</sub> -10	0-2 PPM	Germane	GeH <sub>4</sub>
N <sub>2</sub> H <sub>4</sub> -10	0-1 PPM	Hydrazine	N <sub>2</sub> H <sub>4</sub>
H <sub>2</sub> -10	0-100 PPM	Hydrogen	H <sub>2</sub>
H <sub>2</sub> -10	0-100 %	LEL Hydrogen	H <sub>2</sub>

HBr-10	0-30 PPM	Hydrogen Bromide	HBr
HCL-10	0-30 PPM	Hydrogen Chloride	HCL
HCN-10	0-30 PPM	Hydrogen Cyanide	HCN
HF-10	0-10 PPM	Hydrogen Fluoride	HF
CH30H-10	0-100 PPM	Methanol	CH30H
CH3SH-10	0-100 PPM	Methyl Mercaptan	CH3SH
NO-10	0-100 PPM	Nitric Oxide	NO
NO2-10	0-5 PPM	Nitrogen Dioxide	NO2
O3-10	0-1 PPM	Ozone	O3
COCL2-10	0-1 PPM	Phosgene	COCL2
PH3-10	0-5 PPM	Phosphine	PH3
SiH4-10	0-50 PPM	Silane	SiH4
SO2-10	0-20 PPM	Sulfur Dioxide	SO2
C4H8S-10	0-100 PPM	Tetrahydrothiophene	C4H8S
C4H4S-10	0-100 PPM	Thiophane	C4H4S
C4H6O2-10	0-100 PPM	Vinyl Acetate	C4H6O2
C2H3CL-10	0-100 PPM	Vinyl Chloride	C2H3CL

## 2.3 ALARM FUNCTIONS AND CONTROLLER CONFIGURATION

Model 10 control modules incorporate several user selectable alarm programming options and general operating options that are accomplished via dip switches. These options include latching of relays, energized/de-energized relays, and alarm firing direction. Reference Figure #1 for the applicable dip switch locations and settings.



### 2.3.1 Latching or non-Latching Relays

All alarms – alarm 1, alarm 2, and fault – can be jumper programmed to operate as latching or non-latching. If an alarm is programmed to latch, its corresponding relay and LED indicator, once activated, will stay activated until the reset button is pressed (assuming, of course, that alarm conditions have cleared).

To program an alarm for latching operation, slide its corresponding switch to the on position. For non-latching operation slide the switch to the off position. The switch locations are as follows: fault - SW2-2, alarm 1 - SW2-8, and alarm 2 - SW2-5.

### 2.3.2 Energized or De-energized

All alarms relays – alarm 1, alarm 2, and fault – can be switch programmed as normally energized or normally de-energized. The standard is de-energized. However, a relay can be programmed as energized to provide application specific features. A normally energized relay will de-energize when in alarm. A typical application of the energized configuration

is to have the fault relay normally energized so that in the event of a power failure to the control module card, the fault relay will de-energize causing its relay contacts to change state, thereby creating a fault output.

It must be noted that when an alarm relay is jumper programmed as normally energized, the contact outputs, normally open and normally closed, become reversed. The normally open contact becomes the normally closed and vice versa. Reconfiguration of the contact output jumpers may be required.

To program an alarm for normally energized operation, slide its corresponding switch to the “on” position. For normally de-energized operation slide the switch to the “off” position. The switch locations are as follows: fault - SW2-1, alarm 1 - SW2-7, and alarm 2 - SW2-4.

### **2.3.3 Ascending or Descending Alarms**

Alarm 1 and alarm 2 can be switch programmed to operate during ascending or descending gas conditions. This feature is useful mainly for the monitoring of oxygen deficiency whereas a decrease in oxygen concentration poses a danger to personnel. However, there may be other applications where the monitoring of a specific gas concentration is desired and alarms can be programmed to operate when that concentration exceeds or drops below a predetermined range. Typically, most applications of monitoring for toxic or combustible gases will warrant that the alarm be programmed as ascending.

To program an alarm for ascending gas conditions, slide its corresponding switch to the “on” position. For descending gas conditions slide the switch to the “off” position. The switch locations are as follows: alarm 1 - SW2-6, and alarm 2 - SW2-3.

### **2.3.4 Display Configuration**

The controller uses standard seven-segment displays and comes from the factory pre-configured for a particular range of detection. The two digit version is standard. A three digit version is also available and is standard for oxygen. A switch is used to program the controller for 2 or 3 digit operation. Additional switches are used to turn on the individual decimal places on the displays. These features are preconfigured at the factory and should not require further adjustment. SW3-1 selects between a 2 digit or 3 digit display. SW3-3 will turn the decimal point either on or off, and SW3-2 sets the location of the decimal point.

### **2.3.5 Detector Power Sense Switch**

This switch should be left in the “ON” position at all times.

### **2.3.6 Alarm 2 Silence**

Alarm 2 can be switch programmed to allow it to be reset in the event of an alarm, even if the alarm condition still exists. This feature would be mainly used if there were a strobe light activated by Alarm 1 and a horn Activated by Alarm 2. In the event of an alarm both the horn and strobe would be engaged but the horn could be silenced and would remain silenced until the alarm condition went away and a new alarm occurred. To program Alarm 2 for the silence feature turn the switch “on”. For normal operation of Alarm 2 turn the switch off. This switch is located at SW3-5.

### **2.3.7 Alarm Reset**

An alarm reset switch (SW1), located on the control module face plate is used to reset alarms that have been programmed as latching. Once alarm conditions have cleared, alarms may be reset by simply pushing the momentary switch and releasing it.

Remote reset outputs are also a feature of the Model 10 control module. This feature is available when used in conjunction with Model 10 compatible control enclosures and mainframe motherboards.

## **2.4 CONTROLLER OPERATION AND MENU SELECTIONS**

Upon applying power, the display will show **dc** for approximately 2 seconds. The controller will then enter normal operation mode, displaying the gas concentration. There is a 15 second period after power-up in which alarms are ignored.

### **2.4.1 Selecting and Adjusting Menu Selections**

Besides acting as an alarm reset, the front panel switch is used to access and navigate through the programming menu system. The Switch functions as both an Enter Key, and as a Selection Key. When it is pressed and held for more than 2 seconds it will act as an Enter Key. When it is momentarily pressed it acts as a Select Key.

To enter the Program Menu press and hold the front panel switch for 10 seconds until the display reads **Pr** then release. Momentarily pressing the switch again after this will scroll through the program options.

The options are as follows:

**Pr** Program status  
**rA** Range adjust  
**A1** Alarm 1 adjust  
**A2** Alarm 2 adjust  
**Id** RS-485 ID adjust  
**CA** Calibration  
**tE** Test mode

To enter into a function momentarily press the switch until the desired option is shown on the display, then press and hold the switch for 2 seconds until the display reflects that function's value. That function's value can now be adjusted by momentarily pressing the switch until the desired value is reached. To accept the new value simply hold down the switch for 2 seconds until the display returns to the Program Menu. The controller will return to normal operation when there is no key press after 15 seconds.

For example, the following steps would allow adjustment of alarm 1:

1. During normal operation press and hold the switch for 10 seconds until the display reads **Pr**.
2. Momentarily press the switch and the display will read **rA**.
3. Momentarily press the switch and the display will read **A1**.
4. Press and hold the switch for 2 seconds until the display shows the alarm 1 set-point, i.e. **30**.
5. Now momentarily press the switch to change the alarm set-point to the desired value.
6. Press and hold the switch to accept the new value. The display will return to displaying **A1**.

The controller will return to normal operation when there is no key press after 15 seconds.

#### 2.4.2 Program Status.

The Program status function (**Pr**) scrolls through and displays the controllers current settings. Upon entering this function the display will read somewhat as follows depending on the settings.

**rA/99** Range is set to 99  
**A1/20** Alarm 1 is set at 20  
**A2/40** Alarm 2 is set to 40  
**Id/01** Modbus ID is set to 01

#### 2.4.3 Range Adjustment

The range function (**rA**) allows the adjustment of the full scale reading of the controller. Range is adjustable between 5 and 99 on a two digit controller and between 5 and 999 on a three digit controller. Range is adjustable in 5ppm/% increments.

#### 2.4.4 Alarm 1 and Alarm 2 Adjustment

The Alarm adjustment functions (**A1** & **A2**) allow for the adjustment of the alarm trip point levels in 1ppm/% increments. Alarms are adjustable between 10% and 90% of the Range of the controller. Example: If the range is set to 99, the alarms can be adjusted between 10 and 90. During adjustment the appropriate LED for that alarm will light.

#### 2.4.5 Modbus ID Adjustment

The Modbus ID adjustment function (**Id**) allows for the setting of the Modbus address for serial communications. The address is adjustable and displayed in Hexadecimal format between 01 and FF.

#### 2.4.6 Calibration Mode

This function (**CA**) puts the controller in a mode in which it will behave normally except that it will ignore all alarms and output a 2mA signal until it is taken out of this mode. When in this mode the fault LED will flash and the fault relay will actuate. To return to normal mode enter the program menu by holding for 10 seconds and then select the CA function again and hold for 2 seconds.

### 2.4.7 Test Mode

This function (**tE**) will cause a simulation of applying a full scale gas sample that will take the display through an incremental count up to the top of the range and back down, activating alarms at the programmed set points and allowing verification of alarm outputs, as well as the overrange flashing feature.

## 2.5 POWER INPUT OPTIONS

Standard operating input power of the Model 10 control module is 24 VDC unless 12 VDC is specified at time of order. All of the circuitry of the Model 10 control module, with the exception of relays, will operate on 12 or 24 VDC.

A 24 VDC control module can be converted to a 12 VDC control module by changing the relays. If this is desired, it is recommended that the control modules be returned to Detcon to be converted. However, if technical personnel are used, the 24 VDC relays (OMRON #G6B-2114P-US-DC24) may be replaced by 12 VDC relays (OMRON ##G6B-2114P-US-DC12) at the owner's discretion. Caution: note that the only identification for required input power is the labeling on the alarm relays.

## 2.6 ANALOG 4-20 mA SIGNAL INPUT/OUTPUT

The Model 10 receives an analog 4-20 mA signal input and converts it to the specified range of detection. The signal is processed through an analog to digital converter and is calibrated so that a 4 mA input will provide a display readout of "0" and a 20 mA input will provide a display readout equal to full-scale range. This circuitry is factory set. Should adjustment become necessary, refer to the controller calibration section (section 2.10).

## 2.7 RS-485 MODBUS™ FEATURES AND SPECIFICATIONS

Model 10 control modules feature Modbus™ compatible communications protocol and are addressable via the programming menu for multi-point communications. Communication is two wire, half duplex, with the Model 10 control module set up as a slave device. A master controller up to 4000 feet away can theoretically poll up to 256 different Model 10 control module cards. This number may not be realistic in harsh environments where noise and/or wiring conditions would make it impractical to place so many devices on the same pair of wires. If a multi-point system is being utilized, each control module should be set for a different address. Typical address settings are: 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B, 0C, 0D, 0E, 0F, 10, 11, etc.

Model 10 control module ID numbers are set via the programming menu as described in section 2.4.1.

The following register list describes the parameters available from the Model 10 control module:

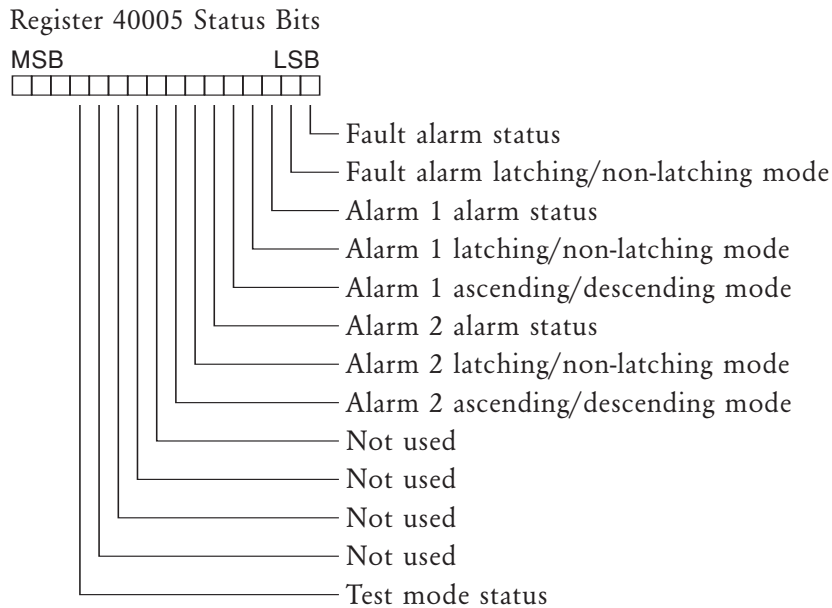
40000	Range
40001	Reading
40002	Alarm 1 Set Point
40003	Alarm 2 Set Point
40004	Not Used

## 2.8 FAULT CIRCUIT FUNCTIONS

Model 10 control modules feature fail safe supervisory circuits designed to assure maximum reliability in system performance. A fault condition will cause the fault LED to illuminate and the fault relay to actuate. The exception to this is if the fault relay is jumper-programmed as normally energized, a loss of external 24 VDC power or the internal 5 VDC supply will cause the relay to de-energize but the LED will not illuminate. Below is a list of conditions that will cause a fault alarm:

1. Loss of 24 VDC power to the Model 10 control module (only if relay is programmed as normally energized).
2. Open power loop from the control module to the gas sensor. Displayed as "OH"
3. Open signal loop from the control module to the gas sensor. Displayed as "SF"
4. When used with a Detcon TP series solid state H<sub>2</sub>S sensor – an open heater on the sensor chip. Displayed as "OH"
5. When used with a Detcon FP series combustible sensor – an open catalytic bead or bridge. Displayed as "OH"
6. Loss of the internal 5 VDC supply (only if relay is programmed as normally energized).
7. Signal level drift below 2.4 mA from the gas sensor. Displayed as "SF"





## 2.9 OTHER FEATURES

Model 10 control modules include other features which are discussed below.

### 2.9.1 Flashing Overrange

The flashing overrange feature will cause the display to flash on and off, at approximately one second intervals once the top of the range has been exceeded. After the signal drops back into the normal range, the display will cease flashing and operate normally.

### 2.9.2 PolySwitch Overcurrent Protection

Model 10 control modules incorporate PolySwitch overcurrent protection components that act as resettable fuses. The PolySwitch circuit protector is a positive temperature coefficient resistor that undergoes a large, abrupt change in resistance when an overcurrent or high temperature heats it above a specific point. Normally just tens of milliohms, the resistance of the PolySwitch protector increases orders of magnitude when switched. This increase limits current to several milliamps.

When the current or temperature fault that caused the device to switch has been substantially reduced, the PolySwitch device resets, allowing normal circuit operation to resume. The protector requires no manual resetting or replacement. Four separate Poly Switches monitor and protect the following circuitry: the 4-20 mA signal input loop, the 4-20 mA output signal loop, the 24 VDC input power loop, and the 24 VDC output power loop to the sensor.

### 2.9.3 Initialization Mode

If the calibration switch on the side of the PCB is pressed during insertion of the PCB or during the first 2 seconds after power up, the unit will enter an initialization mode. The initialization acts as a master reset and should only be executed to restore the controller and its internal memory to factory default values. Initializing the controller will overwrite all factory calibration values, alarm set points, 485 ID, and range settings. Initialization is performed at the factory prior to shipment and is not normally required in the field.

If the initialization is activated, the display will show **It**. The following operations are performed by the controller during an Initialization.

1. Default zero (250) and span (4000) values are written to nvram.
2. The controller reads the status of the 3d/2d switch.
3. If 3d is selected the default range is set to 999. If 2d is selected the default range is set to 99.

4. Alarm 1 is set to 20% of the default range.
5. Alarm 2 is set to 50% of the default range.
6. The RS-485 address is set to 01h.

## 2.10 CONTROLLER CALIBRATION

The 4-20 mA output of the Model 10 control module is calibrated at the factory and should require no further adjustment. If under some special circumstance calibration is required, use the following instructions. To calibrate the controller you will need an extender card and have to be able to simulate a 4mA input and a 20mA input.

### 2.10.1 Calibrating Zero

Follow the steps below to calibrate the zero (4 mA) signal level input:

1. Input a 4ma signal to the controller.
2. Press and hold the calibration switch SW4 (see figure 1) until the display reads **CL**. After 3 seconds the display will read **2E** (zero).
3. Press and hold SW4 until the display flashes **2E**. The zero reading has been read and saved. The output 4-20 mA should now reflect the input signal. The display will stop flashing and display **2C** (zero complete) for 3 seconds and will return to displaying **2E**. The controller will return to normal operation if there is no key press after 15 seconds or by pressing the front panel switch.

### 2.10.2 Calibrating Span

Follow the steps below to calibrate the span (20 mA) signal level input.

1. Input a 20 mA signal to the controller.
2. Press and hold the calibration switch SW4 (see figure 1) until the display reads **CL**. After 3 seconds the display will read **2E** (zero).
3. Momentarily press SW4 until the display reads **SP**.
4. Press and hold SW4 until the display flashes **SP**. The span reading has been read and saved. The output 4-20 mA should now reflect the input signal. The display will stop flashing and display **SC** (span complete) for 3 seconds and will return to displaying **SP**. The controller will return to normal operation if there is no key press after 15 seconds or by pressing the front panel switch.

## 2.11 WARRANTY AND SERVICE POLICY

Detcon, Inc., as manufacturer, warrants each new Model 10 series digital electronic control module to be free from defects in material and workmanship under intended normal use for a period of one year from date of shipment to the original purchaser. Detcon, Inc., additionally provides for a fixed fee repair/replace service policy which covers Model 10 series digital control modules for a period of five years. The fixed fee service policy shall affect any necessary factory repair for the period following the one-year warranty period and shall end five years after expiration of the warranty. The fixed policy rate is \$75.00 per control module, per transaction, during the period of the policy. The policy is FOB Detcon, Inc., The Woodlands, Texas.

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