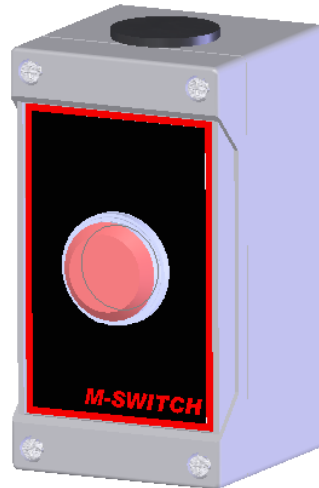


M-SWITCH

SWITCH INPUT IN GAS CONTROL SYSTEM



INSTALLATION OPERATION AND MAINTENANCE MANUAL

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READ BEFORE OPERATING

All individuals who have or will have the responsibility of using, maintaining, or servicing this product must carefully read this manual. The product will perform as designed only if it is used, maintained, and serviced in accordance with the manufacturer's instructions.

1. General Information

1.1 Principle of Operation

The M-Switch is a microcontroller based digital transmitter, which can provide a switch input for M-Controller System and Q4 Controller System to actuate or reset any assigned outputs, such as Relays, Buzzers and Strobe. With remote switch TB3, it not only provides onboard switch input, but also can receive remote switch from up to ten R-Switch or other customer dry contact output.

M-Switch converts Switch Status to gas concentration and communicates with Controller System. It occupies one digital sensor address in the Controller System and works as a digital sensor, so the M-Controller and Q4 Controller can get the simulated gas concentration and determine if the assigned outputs are triggered to actuate or reset.

M-Switch outputs 0 when switch status is OFF, and 9999 when the switch status is ON.

M-Switch has a six positions DIP Switch onboard to define its address and functions in Controller System, the address can be set to 0 to 31 by using position 1 to position 5 of the DIP Switch. The digital sensor address that M-Controller supports is 0 to 31, and Q4 Controller supports address 0 to 3.

The Switch Input can be defined with Latch function or without Latch function by using the DIP Switch position 6. With Latch function, the M-Switch will always output 9999 once a switch is pushed, that means the switch will always keep ON state until its power is switched off or a connected Reset Switch is pressed. Without Latch function, the M-Switch will alternately output 0 and 9999 every time a switch is pushed.

M-Switch has one switch onboard. It also contains two terminal blocks for connecting Remote Switch. If an R-Switch is connected to the Remote Switch Terminal Block, the R-Switch will have the same function as the switch onboard. If an R-Switch is connected to the Reset Switch Terminal Block, the R-Switch will be used as a reset switch to reset latched switch, which might be the switch onboard or other remote switch connected to the Remote Switch Terminal Block.

M-Switch and R-Switch both have a LED Switch Indicator to show the switch status. When the switch status is ON, the LED is turned RED, when the switch status is OFF, the LED is OFF.

1.2 Key Features

- One Channel Switch Input Onboard
- Able to drive up to 10x R-Switch at Remote Switch Terminal Block in serial
- Able to drive up to 10x R-Switch at Reset Switch Terminal Block in serial
- All Remote Switch have the same functions as the switch onboard
- All Reset Switch have the same functions
- Supper Bright Red LED Switch Indicator
- Water and corrosion resistant PVC **Enclosure NEMA 4, 4X**
- Latch or non-Latch function selectable
- Pushbutton with splash cover meets **IP65 of IEC60529 specifications**
- RS-485 interface with OptoMux Protocol for Controller System
 - Fixed baud rate: 4800bps
 - 1 start bit / 8 data bits / 1 bit stop
 - No parity
 - Addressable from 0 to 31
 - RS-485 driver: SKU# 3200-0044 with 60V Fault Protected
 - Removable RS-485 driver with socket
 - Selectable 120 Ohm terminator
 - RX, TX LED indicator
 - Removable terminal block for RS-485
- Operation at 15–24VAC or 18–30VDC
- CSA/UL approval (pending)

1.3 Applications

In many Gas Detection Systems, switch inputs are needed either for testing system outputs, such as Relays, Strobe, Horn and Fans, or for emergency to turn on/off specific Outputs. The M-Switch is providing the functions to our gas controller system. Working with M-Controller and Q4 Controller, the M-Switch and R-Switch not only can provide multi-switch inputs and parallel switch inputs, it also provide a way to bring other devices switch outputs to M-Controller System or Q4 Controller System, such as actuating an M-Relay by customer's emergency switch, a timer/clock status, or actuating a fan by a temperature sensor status, etc. The applications are almost unlimited.

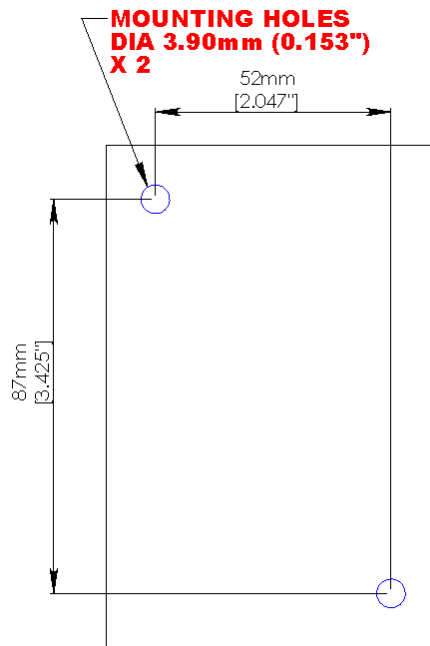
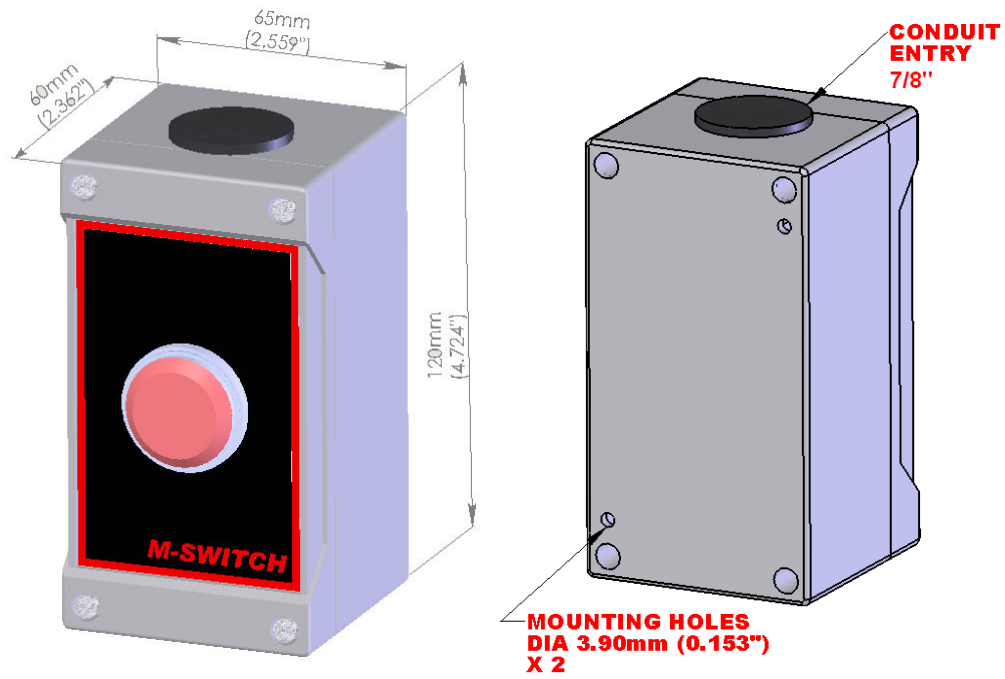
Working with M-Switch and R-Switch, QEL “IR-FREON Control System” also meets the requirements of **CSA B52-05 “Mechanical refrigeration code”**. The Latched M-Switch can be installed outside the machinery room and non-Latched M-Switch can be installed inside the machinery room. So the M-Switch located outside the machinery room shall be capable of starting but not stopping the ventilation. R-Switch can be installed at other locations with the same function as its connected M-Switch. Another R-Switch might be needed to reset the Latched M-Switch.

1.4 Specifications

Input Power:	24VDC nominal, range 18 to 30VDC 24VAC nominal, range 15 to 24VAC 50/60HZ
Fuse:	F1 1A Very Fast-Acting Fuse Littelfuse: Axial Lead and Cartridge Fuse Part Number: 0251001 Must be CSA/UL approved.
Output Signal:	RS-485 with OptoMux protocol <ul style="list-style-type: none">• Available Controller: M-Controller Q4 Controller Output 0 at Switch is OFF Output 9999 at Switch is ON
Switch Indicator:	Super Bright Red LED
Onboard Switch Style:	Momentary Pushbutton With Splash Cover Meet IP65 of IEC60529 Specification
Switch Input:	M-Switch can be configed as <ul style="list-style-type: none">• Momentary Switch Style (J2 pin2-4)• ON-OFF Switch Style (J2 pin4-6)
Enclosure Rating:	IP 66 & NEMA 4, 4X, 12 & 13 Cover Screws should be torqued to 2.5lbs-in (30cN-m)
Operating Temperature:	-45°C to 65°C
Ambient Humidity:	5% to 95% RH (non-condensing)
Storage Temperature:	-45°C to 70°C
Size:	120mm X 65mm X 60mm
Weight:	Less than 0.5 lbs (0.227 kg)

2. Installation

2.1 M-Switch and R-Switch Physical Dimensions

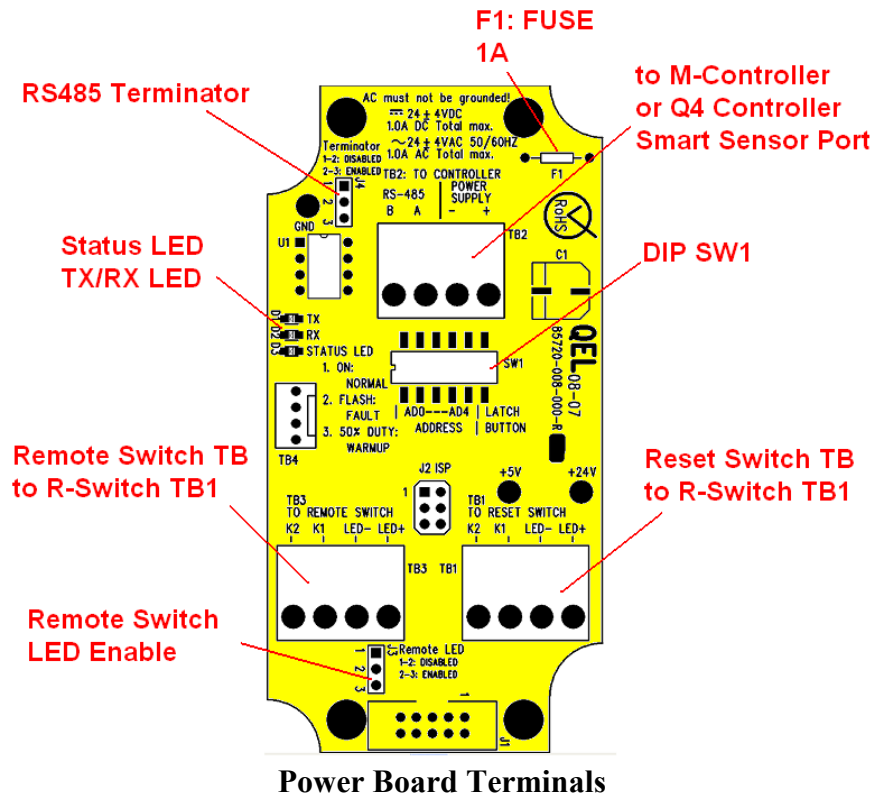


FRONT VIEW

2.2 Mounting and System Wiring

NOTE: The M-Switch or R-Switch may be mounted any position as long as easy button access. Mounting hole size is shown above.

2.2.1 Terminals



2.2.2 Power Supply

Power Supply:

Voltage:	~ 24 ± 4 VAC	50/60Hz	1.0A AC Total max.
	24 ± 4 VDC		1.0A DC Total max.

Note: AC Power must be non-grounded (floating).

Note: No external over-current protection is required. Over-current protection is provided by means of fuses F1.

Fuse F1: 1A Very Fast-Acting Fuse and Must be CSA/UL approved

Littelfuse: Axial Lead and Cartridge Fuse

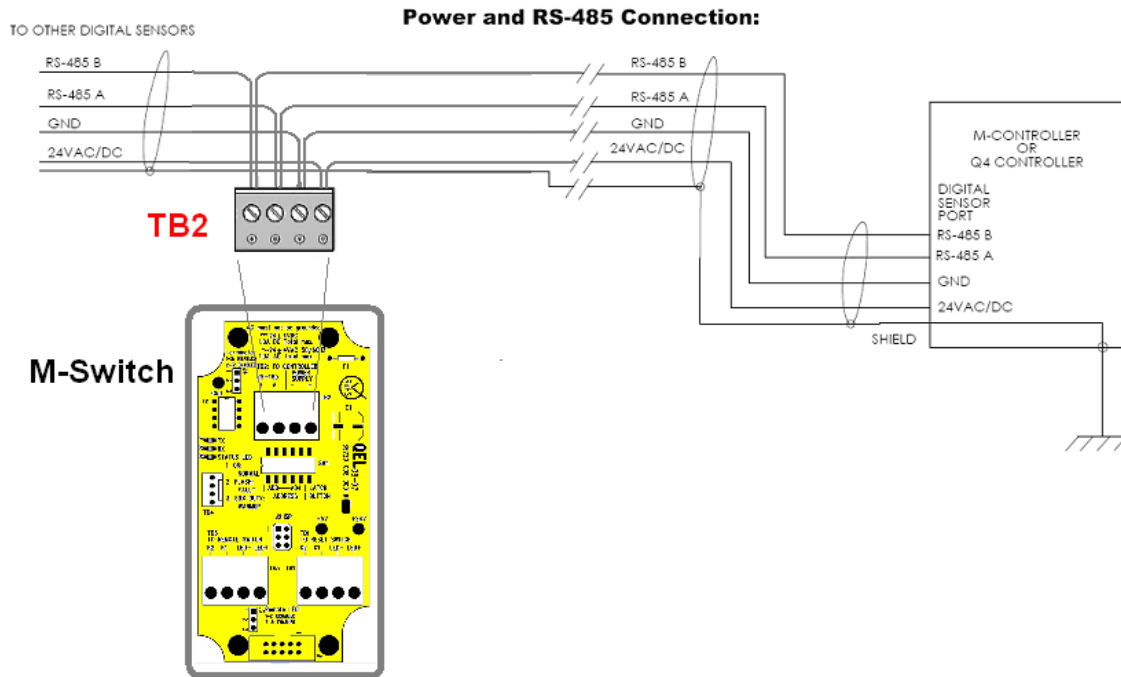
Part Number: 02510001.

2.2.3 Wire and Cable

The terminal block plug TB1-TB3 accepts 12 AWG to 24 AWG wire, Use 16 AWG or 18 AWG wire for Power Supply in long wiring runs, which can be up to 1km (1,000 meters) long.

We recommend using BELDEN 9841 for communications. This wire has 120 ohm input impedance, which will eliminate RS-485 communication problems.

2.2.4 Connection



2.2.5 RS-485 Terminator

The terminator on each end of the RS485 loop is designed to match the electrical impedance characteristic of the twisted pair loop, and will prevent signal echoes from corrupting the data on the line. The terminator should be enabled on BOTH ends of the RS485 loop. Short and medium length modbus/485 loops can operate without the terminating resistor. Longer runs may require the terminating resistors. But adding terminator dramatically increases power consumption.

Factory default setting is disabled terminator.

The M-Switch supplies this resistor on the main board, and it is chosen using a jumper at J4.

J4 1-2: Terminator Disabled / OFF (default)

J4 2-3: Terminator Enabled / ON

2.2.6 RS-485 Driver Replacement

RS-485 lines in heavy industrial environments are sometimes subjected to magnetic disturbances causing sufficient inducted power surges to damage the driver integrated circuit (IC). This IC U1 is socketed on the circuit card for ease of replacement in the field.

3. Function and Configuration

3.1 System Initialization

When the M-Switch is turned on, it initializes hardware and software. During Warming up procedure, the status LED blinks at 50% duty ON. The warming up period is very short.

After Warming-up procedure or in Normal Working Mode, if there are no errors, the Status LED is turned ON constantly. If there is an error, the Status LED blinks once every second. An error message will display on the M-Controller or Q4 Controller panel.

3.2 Status LED

The Status LED indicates the status of the M-Switch is running:

- Always ON: Normal Working Mode
- Blink once every second: Fault report
- Blink 50% duty on: Warming up Mode

3.3 RS-485 Indicators

When the M-Switch is connected to a M-Controller or Q4 Controller, the traffic of the communication can be monitored visually through the two RS-485 indicators, one is RX LED, which indicates the data stream received from the controller. The other is TX LED, which indicates the data stream out from the M-Switch.

If the TX LED or the RX LED is always ON, that means the communication has problem. Refer to Section 5: Troubleshooting for RS-485.

3.4 RS-485 Addressing

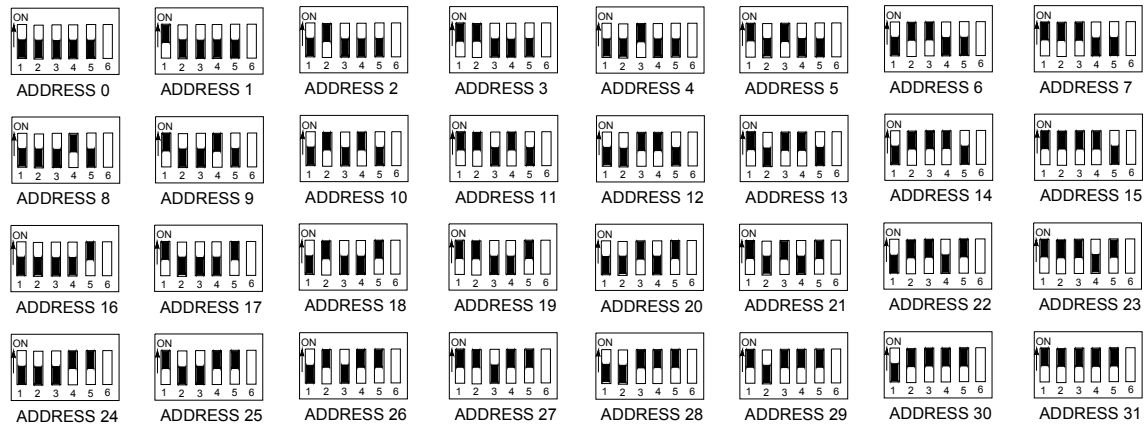
The digital sensor address that M-Controller supports is from 0 to 31.

The digital sensor address that Q4 Controller supports is from 0 to 3.

The M-Switch RS-485 address can be defined from 0 to 31 by using DIPSWITCH SW1 position 1 to 5. Position 6 is used to define the latch function for the Switch onboard and Remote Switch.



Address 0 to Address 31:



M-Switch Address SW1 Setting

3.5 Pushbutton Switch and Indicator

M-Switch has one momentary pushbutton switch onboard. Its splash cover makes the switch meet IP65 of IEC60529 specifications (similar to NEMA 4 and 13). The pushbutton also contains a super bright red LED to indicate the status of the switch.

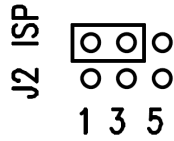
- When the Switch Status is ON or Latched, the LED is turned RED
- When the Switch Status is OFF or Reset, the LED is turned OFF

3.6 Momentary Switch Input vs ON-OFF Switch Input

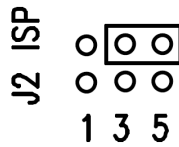
M-Switch can be configured to work with either momentary switch input or On-Off switch input. A momentary switch returns to its normally position when you release the button, the switch onboard is a momentary switch, a standard doorbell switch is a momentary switch. An ON-OFF switch, for example the Single Pole Single Throw SPST, can be

used to switch ON/OFF to a circuit. Timer relay output, motion detector relay output and thermostat relay output are normally ON-OFF switch output, when they are connected to M-Switch, M-Switch should be set to ON-OFF Switch Input Style.

- Config as Momentary Switch Input: Put jumper on J2 pin2-4 (Default)



- Config as ON-OFF Switch Input: Put jumper on J2 pin4-6



When M-Switch is configured as Momentary Switch Input, the M-Switch Switch Status will be alternatively changed. When the onboard switch or a remote switch input is closed and released once, the Switch Status goes to ON status, when the onboard switch or a remote switch input is closed and released again, the Switch Status goes to OFF status. It looks like a Push-Push Switch.

When M-Switch is configured as ON-OFF Switch Input, the M-Switch Switch Status will always be the same status of the onboard switch or the remote switch input. When the onboard switch or a remote switch input is closed, the Switch Status goes to ON status, when the onboard switch or a remote switch input is open and the Latch function is disabled, the Switch Status goes to OFF status. If the Latch function is enabled, the Switch Status is latched to ON status.

3.7 Latch Function

SW1 position 6 = ON: Latch Enabled Switch Input

SW1 position 6 = OFF: Latch Disabled Switch Input

When Latch function is enabled, the M-Switch status will always be ON once the onboard switch or a remote switch is closed, and the switch status cannot be reset to OFF until its power is switched off or a Reset Switch is pressed.

When Latch function is disabled, the M-Switch status will alternately be ON and OFF every time an onboard switch or a remote switch is closed or open. It does not need a Reset Switch to reset to OFF.

3.8 R-Switch

R-Switch is extension of M-Switch. When more than one switch are needed to perform the same function and they are going to be installed at different locations, the R-Switch is the right choice.

R-Switch TB1 can directly connect to M-Switch Remote Switch TB3 or M-Switch Reset Switch TB1. R-Switch TB1 is also able to connect to another R-Switch TB2 in series to perform the same function, the number of R-Switch connected one by one can go up to ten maximum. Depends on which Terminal Block it connects to, the R-Switch will perform appropriate function:

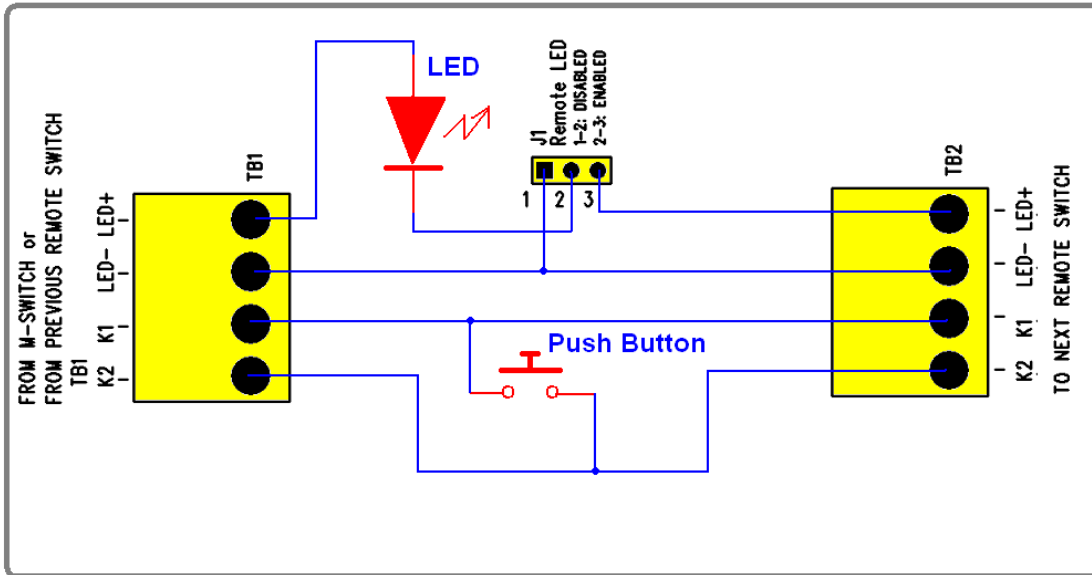
- Connect to Remote Switch TB3, R-Switch performs the same function as the switch onboard of M-Switch
- Connect to Reset Switch TB1, R-Switch can reset the Latched M-Switch and all R-Switches that connect to the M-Switch TB3

R-Switch also contains a supper bright red LED to indicate the status of the switch.

- When R-Switch is used as Remote Switch
 - When the Switch is ON or Latched, the LED is turned RED
 - When the Switch is OFF or Reset, the LED is turned OFF
- When R-Switch is used as Reset Switch
 - When the Switch is pressed, the LED is turned RED
 - After the Latch Switch is reset, the LED is turned OFF

When there is another R-Switch connected to the R-Switch, the Jumper of J3 on this R-Switch should be put between pin 2 and pin 3, so the LED driving current can go to next R-Switch. The last R-Switch in the chain should have jumper on J3 pin 1 and pin2 to loop back the current. J3 default setting is pin1-2.

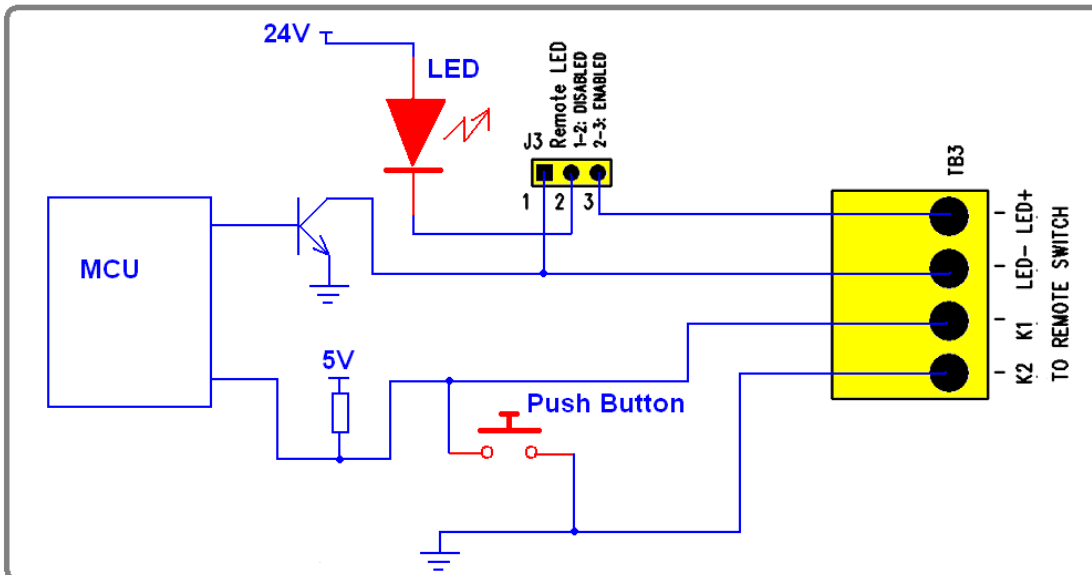
R-Switch schematic is shown below:



3.9 Remote Switch Terminal Block

M-Switch contains two different functions terminal blocks: Remote Switch Terminal Block TB3 and Reset Switch Terminal Block TB1.

Remote Switch schematic is shown below:

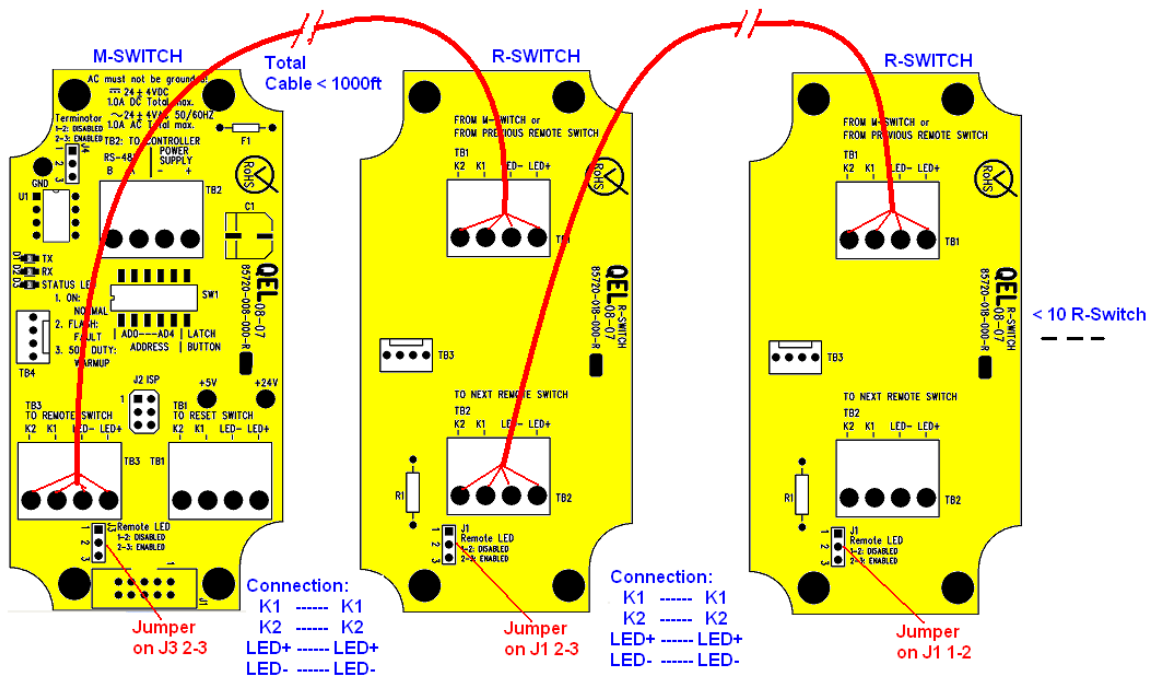


M-Switch TB3 is for connecting Remote Switch. R-Switch or any other dry contact switch can be used as the Remote Switch, such as customer's emergency switch, timer/clock relay output or a temperature sensor relay output. These remote switches will have the same function as the switch onboard. If the switch onboard is defined to be a latched switch, this remote switch will be a latched switch. If the switch onboard is defined to be a non-latched switch, this remote switch will be a non-latched switch.

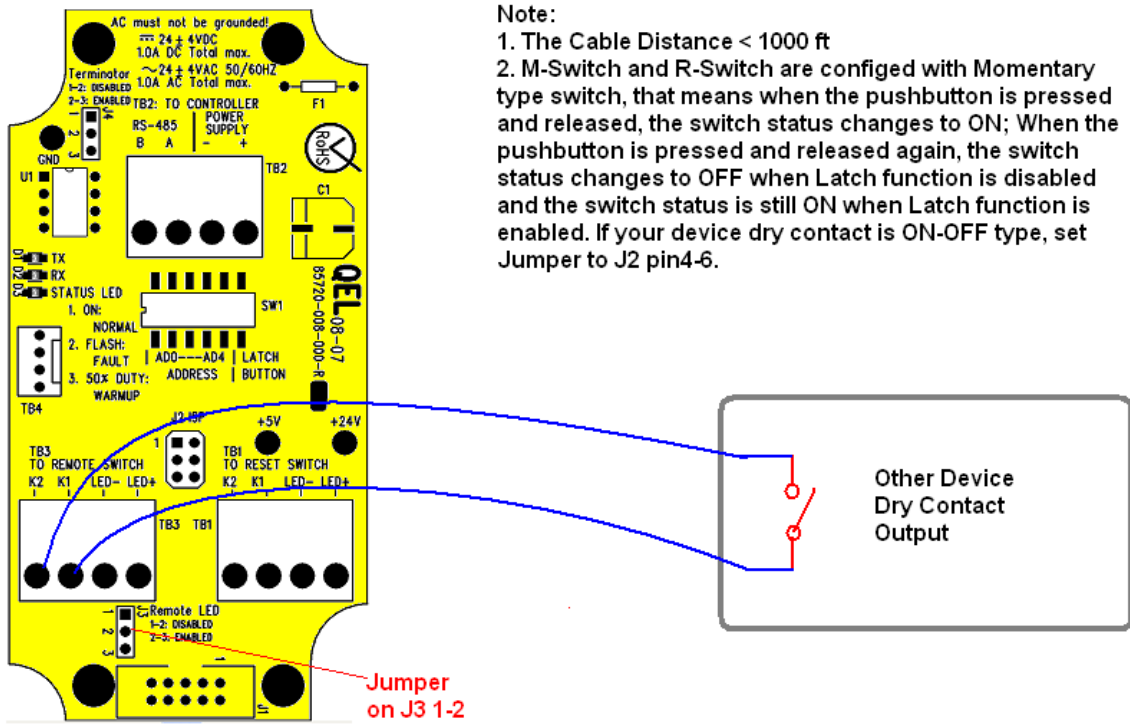
K1 and K2 terminals are for the switch input, which should be a dry contact. They are parallel with the switch onboard. So if any switch is pushed, the circuit is shorted and the changed status can be detected by MCU and the LED is turned ON.

LED+ and LED- terminals are able to output 10mA current to drive the LED indicator in R-Switch. They are in series with the LED indicator onboard. When the jumper is set at J3 1-2, the current is disconnected to LED+, so there is no current output; When the jumper is at J3 2-3, the current will pass through LED+ and go to Remote Switch LED indicator, so if a switch is turned ON, all LED indicators including M-Switch and R-Switch are all turned ON.

When an R-Switch is used as a Remote Switch, the connection is shown below:

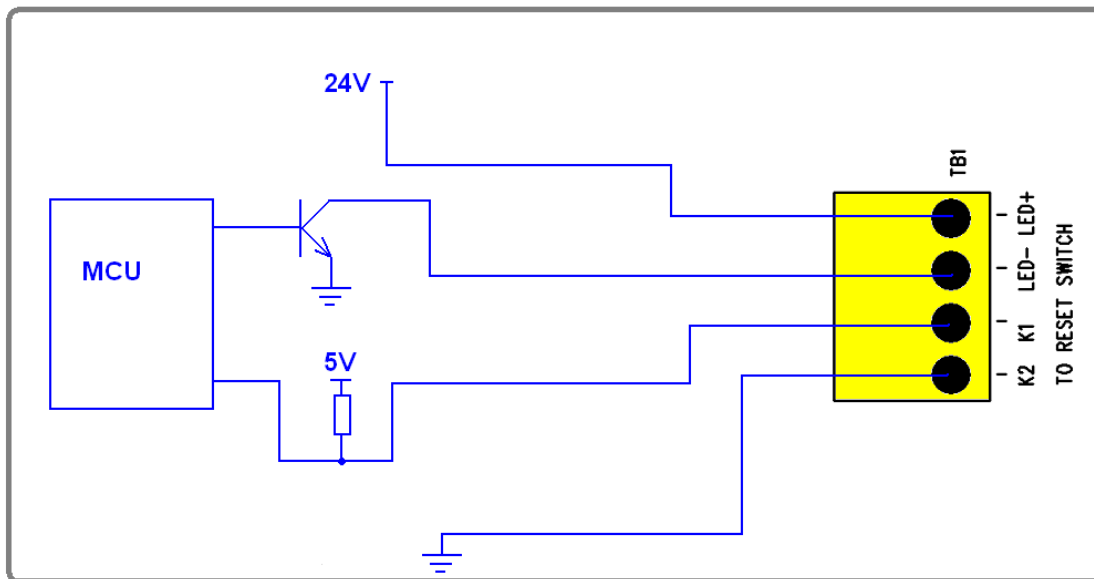


When a dry contact is used as a Remote Switch, the connection is shown below:



3.10 Reset Switch Terminal Block

Remote Switch schematic is shown below:



M-Switch TB1 is for connecting Reset Switch. The TB1 has the same signal character as the Remote Switch TB3 does, except it does not need a Jumper J3 to control the LED current. So the R-Switch and other dry contact switch can be used as Remote Switch too. These reset switches can reset latched M-Switch and Remote Switch.

If the M-Switch is working in non-Latched mode, no reset switch needs to install.

For R-Switch and other dry contact connect to the Reset Switch TB1, please refer to Remote Switch TB3 connections.

4. Troubleshooting

This troubleshooting guide is intended as an aid in identifying the cause of unexpected behavior and determining whether the behavior is due to normal operation or an internal or external problem.

SYMPTOMS	PROBABLE CAUSE	SUGGESTED SOLUTION
RS-485 RX LED or TX LED constantly ON	<ul style="list-style-type: none"> • RS-485 bus connection has problem • RS-485 Driver U1 is damaged • Controller side RS-485 Driver has problem 	<ul style="list-style-type: none"> • Disconnect the Cable to isolate the problem • Replace U1 IC on main board • Replace RS-485 Driver in Controller
Status LED is blinking on 50% duty	<ul style="list-style-type: none"> • In Warming up process • Hardware Circuit has problem 	<ul style="list-style-type: none"> • Wait for the block to warm up • Return to Factory
Reading is not 0 or 9999	<ul style="list-style-type: none"> • Firmware has problem 	<ul style="list-style-type: none"> • Return to Factory

WARRANTY STATEMENT

The information contained in this manual is based upon data considered accurate; however, no warranty is expressed or implied regarding the accuracy of this data. All QEL equipment is warranted against defects in material and workmanship for a period of two years from date of shipment with the following exceptions:

Electrochemical Sensors (Toxic)	Six Months
Catalytic Sensors (Combustible)	One Year

During the warranty period we will repair or replace, at our discretion, any components or complete units that prove, in our opinion, to be defective. We are not liable for consequential or incidental damage to auxiliary interfaced equipment.

A returned material authorization number should be obtained from the factory prior to returning any goods. All return shipments must be shipped freight prepaid and a copy of the maintenance records should accompany the unit concerned.

Warranty should be considered F.O.B. the factory. Labour and travel time are chargeable for any field site visits required for warranty work.

LIMITED LIABILITY

All QEL systems shall be installed by a qualified technician/electrician and maintained in strict accordance with data provided for individual systems in the form of installation/maintenance manuals. QEL assumes no responsibility for improper installation, maintenance, etc., and stresses the importance of reading all manuals. QEL shall not be responsible for any liability arising from auxiliary interfaced equipment nor any damage resulting from the installation or operation of this equipment.

QEL's total liability is contained as above with no other liability expressed or implied, as the purchaser is entirely responsible for installation and maintenance of systems.

This warranty is in lieu of all other warranties, expressed or implied, and no representative or person is authorized to represent or assume for QEL any liability in connection with the sales of our products other than that set forth herein.

NOTE: Due to on-going product development, QEL reserves the right to change specifications without notice and will assume no responsibility for any costs as a result of modifications.

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