



# SIGNAL LINE CONTROL & MONITORING

SLC2 with RS485  
SLM2 with RS485

**Operation Manual**

## SLCM2 Manual

Part number:

A00718C SLC2 with RS485  
A00720 SLM2 with RS485  
A00721C SLC2 End of Line Node  
A00722 PSW2 Module **Not yet available.**  
A00723 PSW2 Driver Node **Not yet available.**  
A00724 SLM2 Remote Display - Optional  
A00725C SLC2 Side Sequence Node  
A00729 SLM2 Bug

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# SLCM2 System Overview

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The **SLCM2** range of modules and accessories is designed to provide reliable and effective conveyor control with simple monitoring via the 2 wire Signal Line of Stop switches, Wander switches and Blocked chute switches.

Failsafe, End of Line termination is used. Sequence control is also available.

## NOTE:

The SLCM2 family of modules is powered from an external 24VDC supply.

## SLC2

Used for signal line control of a conveyor over 2 wires, using a failsafe SLC2 End of Line termination, with sequencing to the EOL module, and also side-sequence (powered by +24V on a third wire) when required.

### Hardware

A00718C SLC2 Module with Sequence A Input

A00721C SLC2 EOL Termination Module with Sequence A Contact

A00725C SLC2 Side Sequence Module with Sequence A Contact

## SLM2

Used in conjunction with SLC2 to provide trip location monitoring of stop switches, belt wander switches and blocked chute switches on a conveyor system.

### Hardware

A00720 SLM2 Module with RS485 Modbus port

A00724 SLM2 Remote Display - Optional

A00729 SLM2 Bug

## PSW2

(Used in conjunction with SLC2 alone or SLC2 and SLM2 to provide Pre-start control and fault monitoring along a conveyor system.)

### Hardware

A00722 PSW2 Module

A00723 PSW2 Driver Node

# 1.SLC2 Module



Figure 2- SLC2 Module

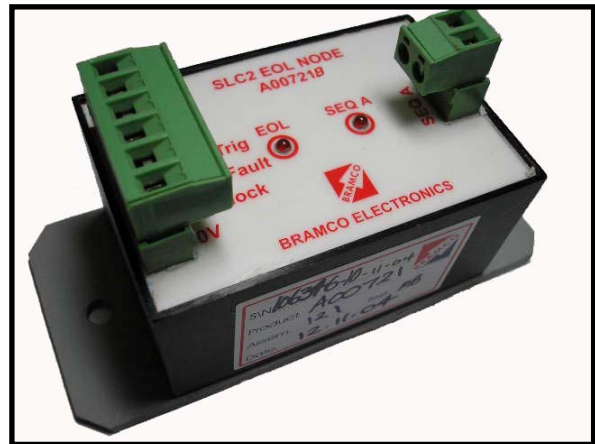


Figure 1 - SLC2 EOL Node

The SLC2 EOL Termination module is wired to using Phoenix plugs, a 6 way for the signal line and a 2 way for SeqA output.

## 1.1. Terminal Connections

Terminal Number	Description
1	POS 24VDC
2	0V
3	SLC2A N/O1
4	SLC2A COM1
5	SLC2B N/O2
6	SLC2B COM2
7	SLC2C HEALTHY OUTPUT 24VDC
8	SEQA ENABLE INPUT
9	SIG LINE POS (SLC2 ALONE)
10	SIG SLM2 (IF CONNECTED)
11	RS485 0V
12	SYNCH TO SLM2 (IF CONNECTED)
13	RS485 DB
14	RS485 DA
15	SIG LINE NEG (SLC2 ALONE)
16	POS 23VDC (OUT TO EOL/SS)

## 2. SLM2 Module



The SLM2 Remote Display module is supplied with a 2m ribbon plugged cable for connection to the front of the SLM2 module. The Remote display is IP65 rated and may be mounted through a front panel for easy viewing.

Figure 3 - SLM2 Module

### 2.1. Terminal Connections

Terminal Number	Description
1	POS 24VDC
2	0V
3	NO CONNECTION
4	NO CONNECTION
5	FAULT COUNT OUTPUT - PULSED
6	FAULT FLAG OUTPUT
7	FAULT COMMON INPUT
8	FAULT LOCATION OUTPUT - mA
9	SIGNAL LINE POS
10	TO TERM 19 ON SLC2
11	RS485 0V
12	SYNCH - TO TERM 12 ON SLC2
13	RS485 DB
14	RS485 DA
15	SIGNAL LINE NEG TO EOL
16	NO CONNECTION

### 3. Product Specifications

Supply Voltage	External 24VDC +/- 10% <b>SLC2</b> only 100mA <b>SLC2 + SLM2</b> 200mA <b>SLC2 +SLM2 +PSW2</b> 250mA
<b>SLC2 MODULE</b>	Monitors the Signal Line for the SLC2 EOL Termination over 2 wires. Addition of +24V on a third wire allows operation with larger line resistances and Side Sequence A operation.
Signal Line Control	Failsafe configuration with SLC2 EOL Termination.
Signal Line Protection features	SHORT, EOL OK, OPEN Led indication. DC, SIG LINE OK, RELAY ON Led indication.
Signal Line Open Drop out delay	2.5 second typical, re-close < 3 seconds (Signal line noise dependant). SLC2 initiates SLM2 to monitor the First Fault location. After a delay, SLC2 turns off SLM2 and looks at the Signal Line.
Signal Line Specs <i>The useable values are application specific</i>	Standard: 500 ohms, 4 mH, 2 uF maximum (2 wire) Higher line resistance is possible (using 3 wire or no sequence)
Sequence A, initiate input to allow next belt to start	Closes contact on SLC2 EOL or Side Sequence Module. Only sent if the SLC2 EOL Termination is healthy.
SLC2 Healthy Output	Switched 24V output, ON when SLC2 is healthy. 1A Max.
SLC2 Relay Function	SLC2 contacts are closed when the signal line is healthy.
SLC2 Relay Contact ratings	2 x N/O - 5A 250VAC, 100VA max.
Serial Port RS485	Modbus ASCII 9600 baud, 7 data bits, even parity, 1 stop bit.
<b>SLC2 EOL MODULE</b>	Can operate and Sequence A over 2 wires – line to 250R
EOL Sequence A Contact	N/O - 0.5A 48VDC 10W MAXIMUM
SLC2 EOL Status Leds	EOL Active - Flashing Red Led, SEQ A ON - Solid Red Led
<b>SLC2 SIDE SEQUENCE MODULE</b>	Bus powered from +23V from SLC2 Module.
Side Sequence A Contact	N/O - 0.5A 48VDC 10W MAXIMUM
SLC2 Side Sequence Status Leds	EOL Active - Flashing Red Led, SEQ A ON - Solid Red Led

<b>SLM2A MODULE</b>	Acts as Slave to the SLC2 Module. Displays location of Current Fault (brightly), Trip Led ON, Last Fault (dimmed), Healthy Led ON, after fault is cleared. TEST facility for total SLCM2 bugs on signal line.
<b>Optional:</b> SLM2A Remote Display	96 x 96 x 90 deep with IP65 Front facia. Supplied with 2m ribbon cable with connectors which plugs between SLM2 module and Remote Display.
SLM2 Bugs	50 maximum. The useable value is application specific. (Orange - Sig Pos, Black - Sig Neg)
Fault Output Relays	Fault Flag – closes when SLM2 is active ( ie Signal line is Open) Fault Count – number of pulses = fault location number Duty cycle - 20mS ON, 20mS OFF Pulses begin about 400mS after the Fault Flag relay closes
Fault Output Relays Rating	Both N/O - 1A 24VDC ( <i>Voltage free contacts</i> )
Fault Monitor mA Output	1mA PER FAULT LOCATION INTO 250 ohms maximum – to PLC <b><i>eg Fault location 20 = 20mA output.</i></b>
Serial Port RS485	Modbus ASCII 9600 baud, 7 data bits, even parity, 1 stop bit.
<b>PSW2 MODULE</b>	Controls the PSW Trigger line and monitors the PSW Fault line.
Fault Relay Contact Ratings	1x N/O 5A 250VAC, 100VA MAX
Run Relay	1x N/O 5A 250VAC, 100VA MAX

## 4. SLC2 Installation and Operation

### Installation

Mount the SLC2 Module and the 24VDC Power Supply Module close to each other. A typical connection diagram is included in Appendix A.

### AC Supply

Wire the 110-240VAC to the Power Supply AC terminals.

Wire the external control circuit to the 2 x N/O SLC2 contacts as required.

### DC Supply

Wire the 24VDC circuit as per the typical connection diagram. See Appendix A.

0V is wired to **terminal 2** on SLC2 Module.

+24V is wired to **terminal 1** on the SLC2 Module.

### Signal Line

The SLCM2 system is designed to work on signal lines with a resistance up to 500 Ohms. For installations with higher line resistances please consult the factory.

#### For a 2 wire signal line system

SLC2 terminal 15 is the **SLC Negative**, which goes (unbroken) down the pull-cable to the 0V terminal on the **SLC2 EOL Termination Module**.

SLC2 terminal 9 is the **SLC Positive** which goes via each pullkey switch, connected in series, down the pull-cable to the **SLC terminal** on the **SLC2 EOL Termination Module**.

#### For a 3 wire signal line system (See factory before using this configuration.)

SLC2 terminal 16 is the +23V for feeding down the signal line cable to the +24V terminal on any **SLC2 Side Sequence Module**.

### Sequence A Operation

The Sequence A input, (+24V) switched by a controlling device, such as a speed switch or PLC, enables any Sequence A device connected across the healthy Signal line.

*Sequence A signalling is not enabled when the Signal Line is unhealthy.*

## Operation

- Apply AC power. The PS DC ON Led should be On.
- Check the output from PS to 24.0VDC. Adjust as required.
- The SLC2 DC Led should be On.

### SLC2 signal line is Healthy

No Red Leds, Green Leds for, EOL OK, SIG LINE OK, RELAY ON will be On. All 3 x SLC2 relay contacts will now be closed.

The SLC2 Module has 3 output relays. 2 x SLC2 relays, each have separate N/O contacts (5A 250VAC rated) and also SLC2 Healthy 24V switched output.

### SLC2 signal line is Open or Short

Red Leds On, EOL OK Off, RELAY ON will be Off. All 3 x SLC2 relay contacts will now be open. Following is a table for SLC2 Signal Line condition Leds.

Signal Line condition Leds (as well as DC On)				
OPEN	SHORT	EOL OK	SIG LINE OK	RELAY ON
On	Off	Off	Off	Off
Off	On	Off	Off	Off
Off	Off	Off	Off	Off
Off	Off	On	On	On

### Open/Short Operation

When the SLC2 module is showing that the signal line is open there is a 2.5 second period when the SLC2 allows the SLM2 control of the line. This happens regardless of SLM2's presence. During this period the SLC2 is unable to detect changes in line condition. If the line becomes shorted during this period the SLC2 will NOT show Short until it takes back control of the line and tests the line's state.

### EOL Termination Module

In **2 wire** mode when the Signal line is healthy the EOL Led should flash every 0.5 seconds. When the Signal line is open the EOL Led will not flash.

In **3 wire** mode, whether Signal line is open or healthy the EOL Led should flash every 0.5 seconds.

When the Signal line is healthy, and a Sequence A command is received, the SEQ A Led will be On solid.

## Typical Voltages:

SLC2 MODULE TERM 9 - 15	SLC2 EOL MODULE SLC – 0V	LINE RESISTANCE	SEQ A CONTACT EOL + S/S MODULES
18.5 – 19.5 VDC	18.5 – 19.5 VDC	50	OFF
15.5 – 17.5 VDC	15 – 17 VDC	50	ON
19 – 20 VDC	16.5 – 18 VDC	200	OFF
15.5 – 17 VDC	12 – 14 VDC	200	ON
19 – 20 VDC	16.5 – 18 VDC	350	OFF
16.5 – 17.5 VDC	12 – 14 VDC	350	ON
18.5 – 19.5 VDC	15 – 17 VDC	500	OFF
16.5 – 17.5	11 – 13 VDC	500	ON

## Notes

Only connect the +23V from the SLC2 Module to the +24V terminal on the EOL Termination Module, if the signal line resistance is above 500 ohms.

When the EOL is +24V powered, the Signal line (SLC – 0V) voltage will be higher at both EOL and SLC2 Module.

## 5. SLC2 RS485 Serial Port

### Protocol

MODBUS ASCII  
7 Data bits, 1 Stop bit, Even Parity  
9600 Baud

### MODBUS Request

Slave ID: 02  
Maximum Delay for response: 600ms  
Minimum Poll Period: 501ms\*  
Accepted Requests: 03 Read Holding Registers

\*It is recommended that the poll period not be a multiple of 5 (Due to system timing with the 500ms period of the EOL)

Valid Holding Registers		
Register	Interpretation of Value	Data
4001	1 =Yes, 0=No	Signal Line Open
4002	1 =Yes, 0=No	Signal Line Shorted
4003	1 =Yes, 0=No	End of Line signal detected
4004	1 =Yes, 0=No	Signal Line ok
4005	1 =Yes, 0=No	Relay Latched
4006	1 =Yes, 0=No	SLC2 Sequence A Active
4007	Integer value of Volts *100	System Reference Voltage
4008	Integer value of Volts *100	Signal Line Voltage
4009	Integer Score (0-100)	EOL Tone Quality
4010	Integer Scale Factor	Line Load Resistance Factor

### System Reference Voltage

The system voltage is scaled by a factor of 100 to provide better resolution and retain an integer value in the register.

### Signal Line Shorted

This register indicates the status of the SHORT Led.

### EOL Signal Detected

This register indicates the status of the EOL Led.

## Signal OK

This register indicates the status of the SIG OK Led.

## Relay Latched

This register indicates the status of the RELAY ON Led.

## Signal Line Open

This register indicates the status of the SIG LINE Led.

## SLC2 Sequence A LED

This register indicates the status of the SEQ A Led. To determine if the EOL node has closed its relay one may compare the Signal Line Voltage value before sending a sequence command to after the command is sent. Since the EOL node draws power from the signal line to close its relay when it is not externally powered, the signal line voltage will drop.

## Signal Line Voltage

This register holds the current signal line voltage. It is scaled by 100 to allow for greater accuracy and still remaining an integer value.

## Line Quality

This register holds the quality of the last EOL tone that was detected. The scores range from 0 to 100. Computed values between 22 and 60 are considered good EOL tones by the SLC2.

It should be noted that if no EOL tones are being detected this value will remain at the last computed value. Only when a new tone is detected will a new value be computed and sent.

## Line Load Resistance Factor

The Line Load Resistance Factor represents the loading on the signal line. Due to the dynamic characteristics of the EOL node this value does not represent the actual load on the line. It should be used in conjunction with the Line Quality measurement to detect line degradation over time.

## Modbus Request Packet Structure

The SLC2 is able to respond to a requested read of any or all of the valid registers. It is possible to request any consecutive range of holding registers or a single register. An example request packet to read the first 7 registers is as follows:

:	To	Func	StartH	StartL	QtyH	QtyL	LRC	CR	LF
3A	02	03	00	00	00	07	F4	0D	0A

: = Start Character ('3A' in Hex)

To = Modbus slave address of module

Func = Function Code

StartH = Start Register (High Byte)

StartL = Start Register (Low Byte)

QtyH = Number of Registers to read (High Byte)

QtyL = Number of Registers to read (Low Byte)

LRC = Longitudinal Redundancy Checksum

CR = Carriage Return ('0D' in Hex)

LF = Line Feed ('0A' in Hex)

Each value (except Start, CR and LF) are sent as two ASCII HEX characters

Eg. 03 is sent as characters "0" "3" (0x30 0x33)

**Note:** The MODBUS 03 command assumes the first Hold Register's address to be 4001. Thus all SLC2 holding registers are addressed as follows:

StartH:StartL	Register
00:00	4001
00:01	4002
00:02	4003
00:03	4004
00:04	4005
00:05	4006
00:06	4007
00:07	4008
00:08	4009
00:09	4010

## MODBUS Response Packet Structure

Each Holding Register is represented by two bytes in the response packet, a high byte and a low byte. The following example is a response to the request to read the first 7 holding registers of the SLC2 under normal conditions.

:	To	Func	nBytes	Open H	Open L	ShortH	ShortL	EolH	EolL
3A	02	03	0E	00	00	00	01	00	01

SigOk H	SigOk L	RelayH	RelayL	SeqA H	SeqA L
00	01	00	01	00	00

SysVH	SysVL	LRC	CR	LF
00	E6	C5	0D	0A

## MODBUS Error Packet Structure

The MODBUS Error response packet from the SLC2 is composed as follows.

:	To	Func	ErrNum	LRC	CR	LF
3A	02	8N	EE	XX	0D	0A

8N = MSB set + requested function code

EE = Error number as shown below

XX = LRC dependant on Func and ErrNum

Error Number	Meaning
01	Invalid Function requested
02	Invalid Register Location requested
03	Invalid Quantity of registers requested

**Note:** The "To" byte of all error packets holds the address of the device sending the error.

**Note:** The MSB of the Function Code will be set in error packet (Resulting in upper nibble always being = '8')

## Checksum Calculation

1. Calculate sum (modulo 256) of all bytes except Start Char ':', LRC, CR and LF.
2. Complement Sum in step 1 (ie.  $255 - \text{Sum}$ )
3. Add 1 to result

Example. If sum of packet = 3 then LRC =  $255 - 3 + 1 = 253$  (0xFD)

## Notes

It is recommended that the SLC2 module be polled at intervals greater than 3 seconds to ensure the module has had time to reset before being read again. (A period of 5 seconds is recommended.)

SLC2 will ignore Broadcast messages and packets that are not addressed as "02".

SLC2 will also ignore packets with invalid CRC.

## Connections

SLC2 terminal 14 is connected to DA,  
SLC2 terminal 13 is connected to DB,  
SLC2 terminal 11 is RS485 0V.

# 6. Troubleshooting

## Problem

When trying a sequence operation the EOL node starts sequencing and then stops. Then re-starts and stops continually.

## Understanding

1. The EOL module initially sees the sequence command sent from the SLC2. Upon drawing current from the signal line to close its relay the signal line attenuates the sequence command from the SLC2 and the EOL node is unable to receive it. When the EOL node stops drawing current and releases its relay the signal line stops attenuating the sequence command and the node is able to again receive the command,

thus repeating the scenario. This happens when the signal line resistance is near the upper working bounds.

2. It is possible that a very noisy line is corrupting the sequence command occasionally.

### Solution

1. Reduce the loading of the signal line.
2. Reduce the amount of noise entering the signal line.

## 7. SLC2 Side Sequence Installation and Operation

### Connections

- Connect the **0V terminal** on SLC2 Side Sequence Module to **Sig Negative** on signal line.
- Connect the **SLC terminal** on the SLC2 Side Sequence Module to **Sig Positive** on signal line.
- Connect the **+24V terminal** on the SLC2 Side Sequence Module to **terminal 16** on the SLC2 Module.

### Operation

The SLC2 Side Sequence Module's EOL Led should remain on when the Signal line is closed and healthy. When the Signal line is healthy, and a Sequence A command is received, the SEQ A Led will be On solid.

## 8. SLM2 Installation and Operation

SLM2 may be used as an independent Monitoring Unit. As such it requires its own 2 cored cable and does not require an end of line terminating unit.

### Installation

Mount the **SLM2 Module** and the **24VDC Power Supply Module** close to each other.

### AC Supply

Wire the 110-240VAC to the Power supply AC terminals.

### Control Terminals

Connect a voltage free contact from the PLC across terminals **12** and terminal **2**. This is the connection which controls the SLM2 requesting it to locate a fault location.

(NOTE 1. This input is to be pulsed in 2.5 second intervals continuously while SLM2 is locating trip locations on the system.)

(NOTE 2. The SLM2 should NOT be requested to locate a trip location until the conveyor signal line has been tripped for at least 2.5 seconds.)

### DC Supply

Wire the 24VDC circuit as per the above diagram Appendix C.

**0V** is wired to **terminal 2 on the SLM2 Module**.

**+24V** is wired to **terminal 1 on the SLM2 Module**.

### SIGNAL LINE

When used as an independent Monitoring Unit.

### Connections.

SLM2 Terminal **15** is the **SLC Negative**, which goes (unbroken) down the pull-cable.

SLM2 Terminal **9** is the **Positive** which goes via each pullkey switch, each connected in series, down the pull-cable

### SLM2 Monitor Bugs:

Each monitored Signal Line stop switch, belt wander, or blocked chute switch will have an A00729 SLM2 bug, connected across the Signal Line, on the SLC2/SLM2 side of the switch. (ie closest to the starter).  
Connections are, Black to SLC Negative, Orange to SLC Positive.  
A maximum of 50 monitor bugs may be connected across the SLC line that is monitored by the SLM2

## SLM2A. Remote Display: A00724

Mount the Remote Display through the front of the enclosure using gasket behind fascia and 2 fixing clamps provided. When mounted correctly it has an IP65 rating.

The SLM2 Remote Display is supplied with a 2m long ribbon cable with matching plugs on each end.

Do not run the ribbon cable near high voltage or high current carrying cables.

Plug each end of the cable into the sockets on the SLM2 and the SLM2 Remote Display.

## SLM2 with SLC2 Operation (see Connection Drwg Appendix B.)

### Installation

Mount the **SLC2 Module**, **SLM2 Module** and the **24VDC Power Supply Module** close to each other.

A typical connection diagram is included in Appendix B.

### AC Supply

Wire the 110-240VAC to the Power supply AC terminals.

Wire the external control circuit to the 2 x N/O SLC2 contacts as required.

### DC Supply

Wire the 24VDC circuit as per the above diagram.

0V is wired to **terminal 2 on SLC2 Module and SLM2 Module.**

+24V is wired to **terminal 1 on SLC2 Module and SLM2 Module.**

### SLC to SLM2 Interconnections

Wire **terminal 10 on the SLC2 to terminal 10 on the SLM2.** (SLC Pos sense)

Wire **terminal 12 on the SLC2 to terminal 12 on the SLM2.** (SLM2 Synch )

### For the Basic SLC2 as described in previous section.

Apply DC power.

The SLM2 DC Led should be ON,  
**HEALTHY** Led ON, the SLM2 will display, — —, ie 2 middle bars.

### *When the SLC2 signal line is Healthy*

No Red Leds, Green Leds for, **EOL OK, SIG LINE OK and RELAY ON** will be ON.

The SLC2 contacts will be closed.

### *When the SLC2 signal line is Open or Short*

Red leds, EOL OK Off, RELAY ON will be Off.

The following is a table for SLC2 Signal Line condition Leds.

Signal Line condition Leds (as well as DC On)				
OPEN	SHORT	EOL OK	SIG LINE OK	RELAY ON
On	Off	Off	Off	Off
Off	On	Off	Off	Off
Off	Off	Off	Off	Off
Off	Off	On	On	On

*When the Signal Line is SHORT, the SLM2 is not activated.*

### Open/Short Operation

When the SLC2 module is showing that the signal line is open there is a 2.5 second period when the SLC2 allows the SLM2 control of the line. This happens regardless of SLM2's presence. During this period the SLC2 is unable to detect changes in line condition. If the line becomes shorted during this period the SLC2 will NOT show Short until it takes back control of the line and tests the line's state.

### SLM2 Operation

#### Connections.

**SLM2 Terminal 15** is the **SLC Negative**, which goes (unbroken) down the pull-cable to the **0V terminal** on the **SLC2 EOL Termination Module**.

**SLM2 Terminal 9** is the **SLC Positive** which goes via each pullkey switch, each connected in series, down the pull-cable to the **SLC terminal** on the **SLC2 EOL Termination Module**.

When the SLC2 is unable to detect the EOL, the SLC2 commands the SLM2 Module to measure the signal line. The measurement process is done in **two** command cycles from the SLC2. The SLM2 will make a measurement in the first cycle (2.5s), return control to the SLC2 (2.5s) and then make a second in the next cycle (2.5s). The total address detection process will take **7.5s**. Only when the SLM2 detects the same value for both of these cycles will it update its display and outputs.

### Fault Flag Relay

The SLM2 **Fault Flag** relay is used to as a signal to indicate that the output current is ready to be measured and the Fault Count Relay is about to count out the address of the trip location. The fault flag relay will close 50ms before the Fault Count Relay is activated. The Fault Flag relay will remain closed until the SLC indicates to the SLM that a signal has been detected from the End of Line (EOL) node.

### Fault Count Relay

The **Fault Count** relay switches On/Off equal to the number of pulses relating to the first Fault location. Pulse duty cycle, 20mS On, 20mS Off. The pulses begin about 50mS after the **Fault Flag** relay closes.

### Fault Flag and Count Relay Timing

See Fig 4 and Fig 5 on page 25.

### Fault Monitor mA Output

The **Fault Monitor mA Output** is then made available for PLC monitoring. Scaling is 1mA per fault location into 250 ohms or less.

The maximum number of bugs that can be connected across the SLC line is 50. For this reason, the current output will be between 0 and 50mA (1 bug for every 1mA sent from the SLM's current output).

**Fault location 20 = 20mA output.**

**NOTE: Location 0 = 0mA**

This mA output remains until the next SLM2 cycle for fault location. This mA output may be used in conjunction with the Fault Flag relay for PLC Fault monitoring.

**When the Signal Line is Shorted, the SLM2 is not activated.**

For multiple signal line faults (not SLC short condition), the closest location to the SLM2 is displayed first. When this trip is cleared the next nearest fault location will be displayed. When the Signal Line returns to healthy, the SLM2 waits a few seconds then holding the **Last Trip** location and then dims the Led display. The SLM2 HEALTHY Led is now on, the TRIP Led is off.

If no SLM2 bugs are connected, the display will read: — —

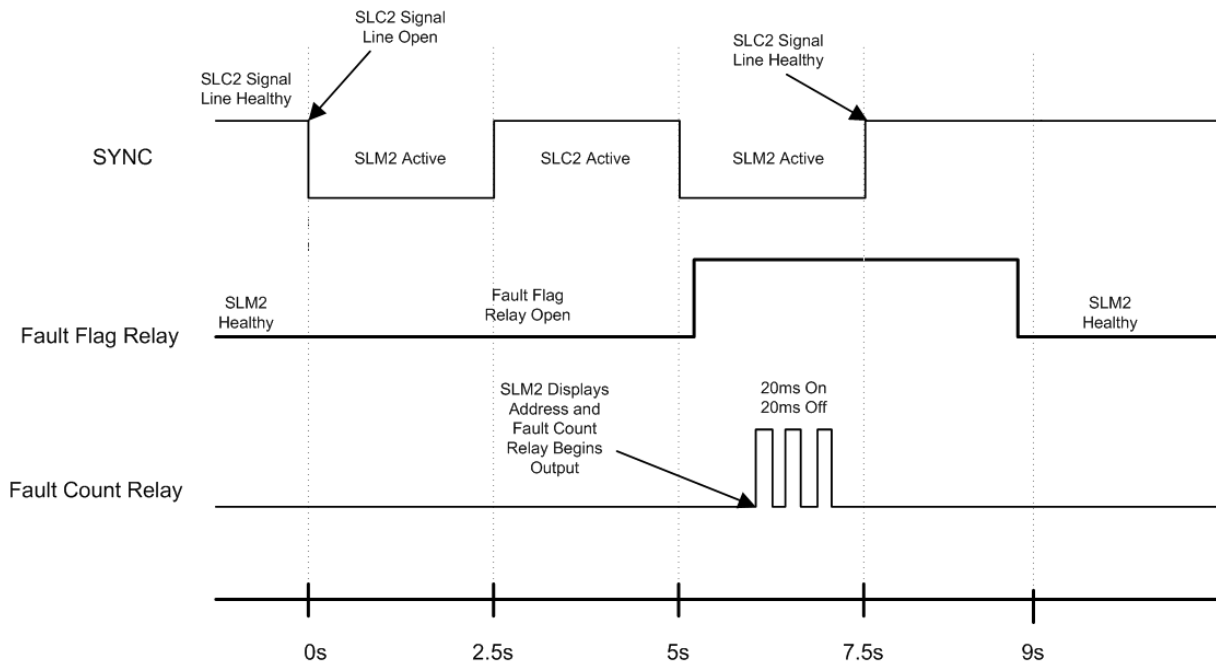
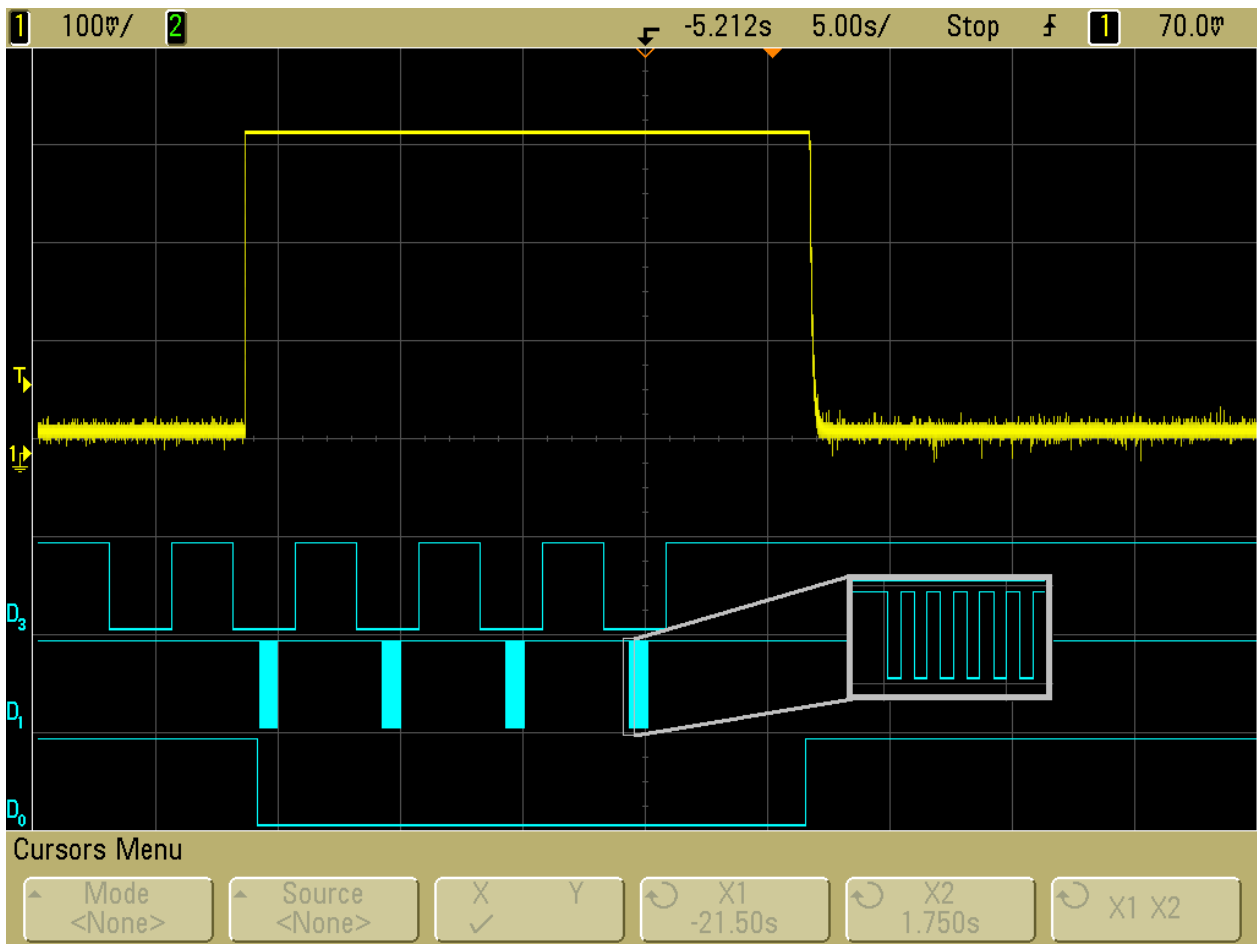


Figure 4 - SLCM2 System Timing



**FIGURE 5 – SLCM2 SIGNAL TIMING**

- Top trace (Yellow) – Current output from SLM
- D3 (First Blue trace) – Sync Pulse from SLC
- D1 (Middle blue trace) – Fault Count relay (Low state indicates contacts closed)
- D0 (Bottom blue trace) – Fault Flag relay (Low state indicates contacts closed)

## SLM2 TEST Feature

A **TEST** button is provided on the SLM2 Module and the SLM2 Remote Display.

If the Signal Line is Healthy, ie ALL GREEN LEDS ON SLC2, operate the **TEST** button **2 times**, holding it down each time for a few seconds. This forces the SLM2 to open the signal line, and to then display the **total number** of SLM2 Bugs on the system.

ie, the Signal Line was closed all the way to the SLC2 EOL Module.

A small round non-metallic actuator is required to operate the recessed **TEST** button.

### Notes:

The **TEST** operation will cause the SLC2 relay to drop out because the signal line is opened.

If **TEST** is activated when the conveyor is running, **TEST** will cause it to stop.

## 9. SLM2 RS485 Serial Port

### Protocol

MODBUS ASCII  
7 Data bits, 1 Stop bit, Even Parity  
9600 Baud

*Note: When using SLM2 with SLC2 for MODBUS polling SLM2 has address 03 and SLC2 has address 02*

### MODBUS Request

Slave ID: 03  
Maximum Delay for response: 2500ms  
Minimum Poll Period: 500ms  
Accepted Requests: 03 Read Holding Registers

Valid Holding Registers		
Register	Interpretation of Value	Data
4001	1=Yes, 0=No	Fault detected since last read.

4002	Integer Value	Trip location
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### Fault Detected since last read

Fault detection has been activated and found a trip location since the last MODBUS read.

### Trip location

This register indicates the number of the last trip location. This translates to the number of bugs detected on the line up to the point of failure.

### MODBUS Request Packet Structure

The SLM2 is able to respond to a requested read of any or all of the valid registers. An example request packet to read the first 2 registers is shown below.

:	To	Func	StartH	StartL	QtyH	QtyL	LRC	CR	LF
3A	03	03	00	00	00	02	XX	0D	0A

- : = Start Character ('3A' in Hex)
- To = MODBUS slave address of module
- Func. = Function Code
- StartH = Start Register (High Byte)
- StartL = Start Register (Low Byte)
- QtyH = Number of Registers to read (High Byte)
- QtyL = Number of Registers to read (Low Byte)
- LRC = Longitudinal Redundancy Checksum
- CR = Carriage Return ('0D' in Hex)
- LF = Line Feed ('0A' in Hex)

Each value (except Start, CR and LF) are sent as two ASCII HEX characters  
Eg. 03 is sent as characters "0" "3" (0x30 0x33)

**Note:** The MODBUS 03 command assumes the first Hold Register's address to be 4001. Thus accessing these registers is done as follows:

StartH:StartL	Register
00:00	4001
00:01	4002

### MODBUS Response Packet Structure

Each Holding Register is represented by two bytes in the response packet, a high byte and a low byte. The following example is a response to the request to read the first 2 holding registers of the SLM2.

:	To	Func	nBytes	fH	fL	IH	IL	LRC	CR	LF
3A	03	03	04	00	00	00	00	XX	0D	0A

It is possible to request any consecutive range of holding registers or a single register thus changing the response to only contain the requested data.

## MODBUS Error Packet Structure

The MODBUS Error response packet from the SLM2 is composed as follows.

:	To	Func	ErrNum	LRC	CR	LF
3A	03	8N	EE	XX	0D	0A

8N = MSB set + requested function code  
 EE = Error number as shown below  
 XX = LRC dependant on Func and ErrNum

Error Num	Meaning
01	Invalid Function requested
02	Invalid Register Location requested
03	Invalid Quantity of registers requested

**Note:** The “To” byte of all error packets holds the address of the device sending the error.

**Note:** The MSB of the Function Code will be set in error packet (Resulting in upper nibble always being = ‘8’).

## Checksum Calculation

1. Calculate sum (modulo 256) of all bytes except Start Char ‘:’, LRC, CR and LF.
2. Complement Sum in step 1 (ie. 255 – Sum)
3. Add 1 to result

Example: If sum of packet = 3 then LRC = 255 – 3 + 1 = 253 (0xFD)

## Notes

It is recommended that the SLM2 module be polled at intervals greater than 3 seconds to ensure the module has had time to reset before being read again. (5 seconds or longer would be sensible).

SLM2 will ignore Broadcast messages and packets that are not addressed as "02".

SLM2 will also ignore packets with invalid LRC.

## Connections

SLM2 terminal 14 is connected to DA,  
SLM2 terminal 13 is connected to DB,  
SLM2 terminal 11 is RS485 0V.

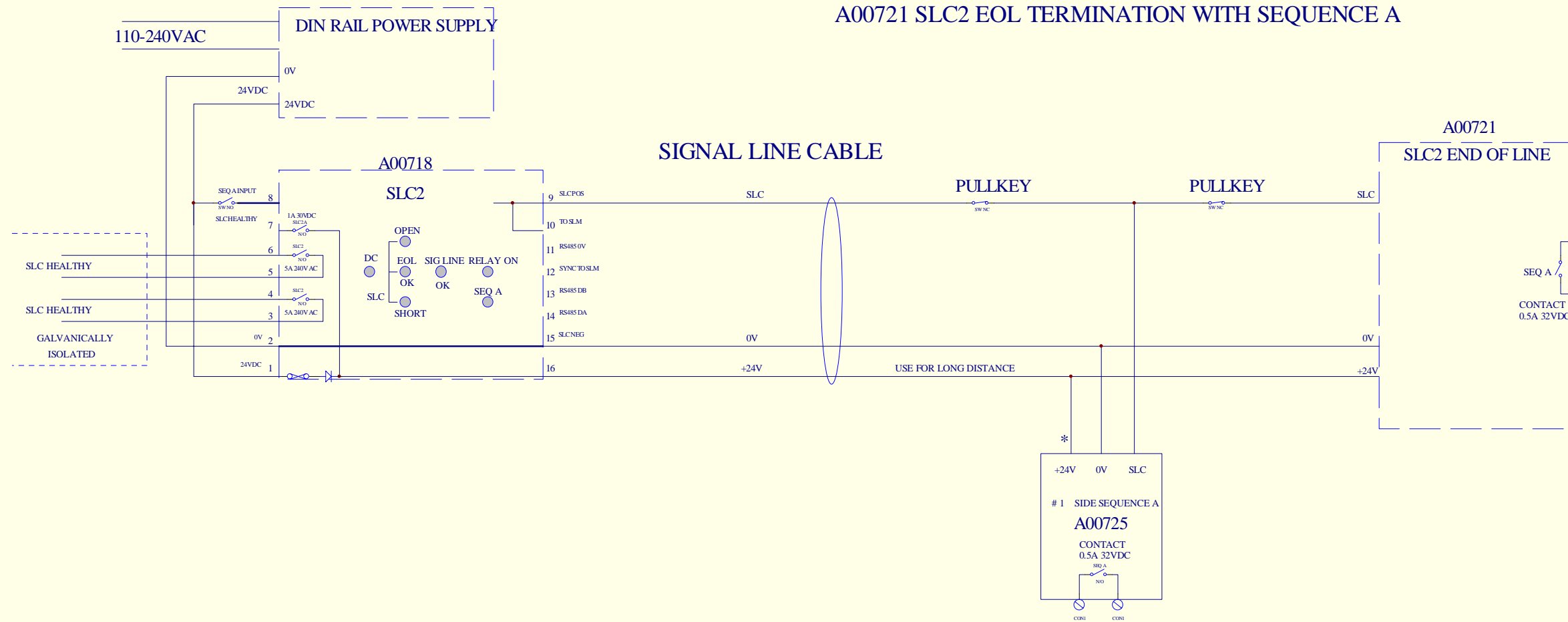
# Appendix A

## NON I.S. SYSTEM

A00718B SLC2 SIGNAL LINE CONTROL WITH SEQUENCE A

A00725 SLC2 SIDE SEQUENCE A

A00721 SLC2 EOL TERMINATION WITH SEQUENCE A



\* REQUIRES EXTERNAL DC POWER

### S91011D

Bramco Electronics	
43-47 Otford Road, Lumberton NSW	
Title: SLC2 SYSTEM WITH SEQA, SIDE SEQA	
Part No: S91011	Rev: D
Drawn By: Tom Parker	Approved By: Tom Parker
Date: 10/2/2009	Date: 21/09/2009
File: S91011.DWG	

# Appendix B

