

Modbus Manual



Automated Fuel Maintenance Systems



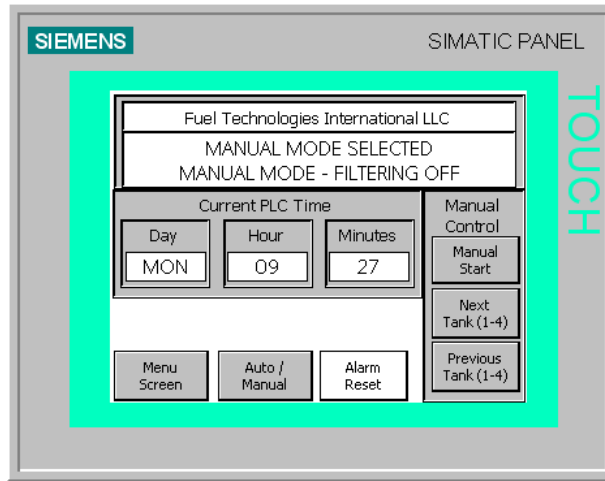
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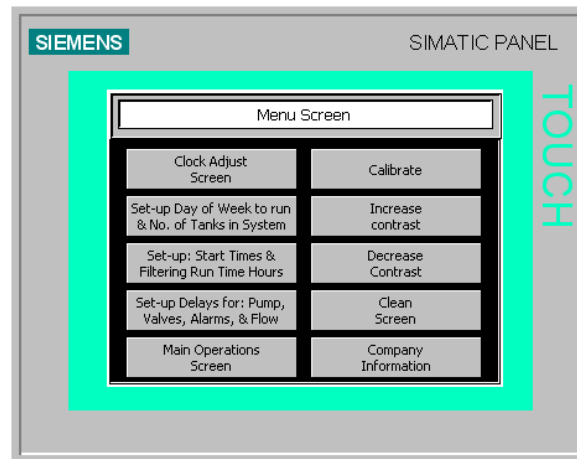
FUEL TECHNOLOGIES INTERNATIONAL LLC

***The Modbus Communications Setup Button is Located
On the FTI Control Panel Touch Screen***

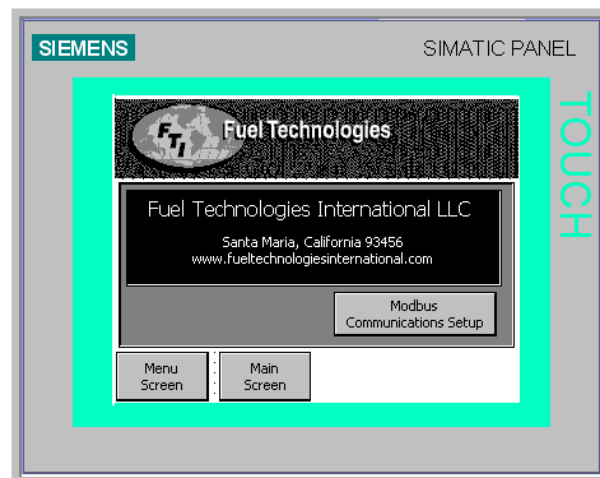
To Access; Push the Menu Screen Button Located on the Main Screen



Then the Company Information Button



Then Push the Modbus Communication Setup Button



MODBUS SETUP:

The PLC system utilizes a Siemens S7-224XP PLC which incorporates two communications ports. PORT 1 on the PLC (leftmost port) is used for communications to the local touch screen display within the control panel itself.0

PORT 0 on the PLC (rightmost port) is used for MODBUS communications to a remote MODBUS master system and utilizes MODBUS RTU RS485 communications.

The default set up communications protocol is as follows: -

PLC MODBUS ADDRESS: 2

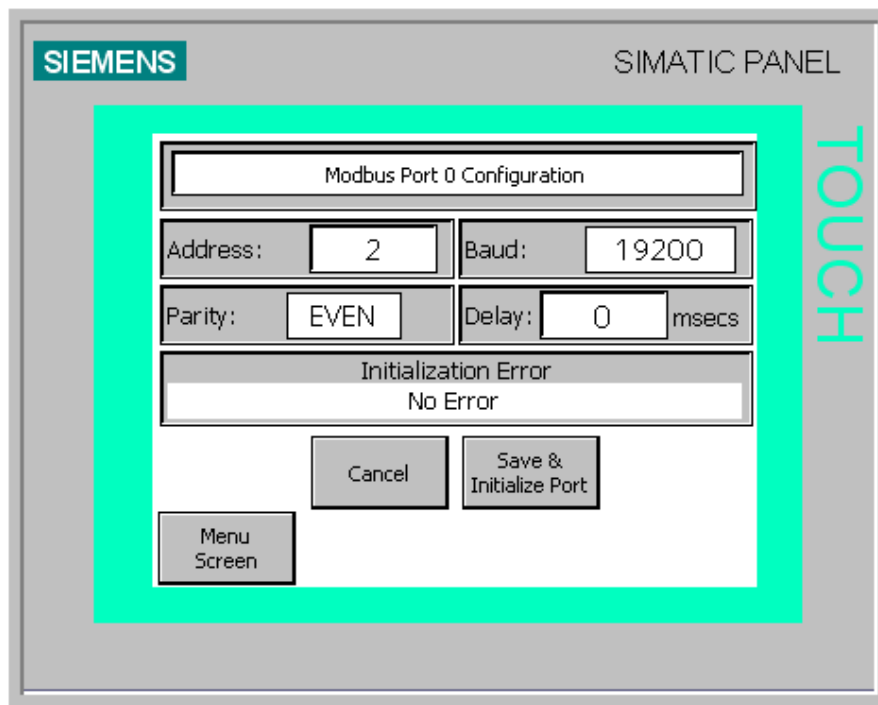
BAUD RATE: 19200

WORD LENGTH: 8

Parity: EVEN

STOP BITS: 1

The PLC ADDRESS, BAUD RATE, PARITY and MODBUS INITIALIZATION DELAY can all be adjusted in the engineering screen on the touch panel.



To make a change to any of the Modbus Protocol settings, press the required value on the screen. Where appropriate, a selection will appear. Select the desired value and when ready press the SAVE & INITIALIZE PORT button. This will send the revised values to the PLC.

Please note that following a protocol change, it is necessary to put the PLC into STOP mode and then restart it before the new settings will take effect. This can be done in one of two ways: -

- 1) Remove Power from the PLC and then re-apply power.
- 2) To the right hand side (front) of the PLC you will find an access door behind which can be found the RUN/TERM/STOP switch. Move the switch from the RUN position down to the STOP position. Then move the switch back up to the RUN position. This will stop and restart the processor and initialize the revised Modbus settings.

Depending upon the function of individual variables within the PLC each may have a Modbus READ address, a Modbus WRITE address or both. In simple terms, the Modbus mapping was designed to provide the user with a means to reflect the functionality of the touch screen display.

Below are the READ and WRITE tables for each of the available variables within the PLC:

TAG DESCRIPTIONS	MODBUS READ		MODBUS WRITE		
	Tag	Modbus Address	Tag	Modbus Address	Value Range
Sets system in auto run mode	<i>MBR_Auto_On</i>	40001.0	MBW_Auto_On	40031.0	
Alarm reset			MBW_Reset	40031.1	
Turn system on & off manually	<i>MBR_Manual_On_Off</i>	40001.3	MBW_Manual_On_Off	40031.3	
Fault / Alarm status	<i>MBR_Fault_Active</i>	40001.7			
Auto Mode -Tank 1 on	<i>MBR_T1_Auto_On</i>	40001.8			
Auto Mode -Tank 2 on	<i>MBR_T2_Auto_On</i>	40001.9			
Auto Mode -Tank 3 on	<i>MBR_T3_Auto_On</i>	40001.10			
Auto Mode -Tank 4 on	<i>MBR_T4_Auto_On</i>	40001.11			
Auto pressure relief active	<i>MBR_P_Relief_On</i>	40001.12			
Strainer/Vacuum alarm	<i>MBR_Mesh_100_Flt</i>	40002.0			
1 Micron filter alarm	<i>MBR_Filter_1_Flt</i>	40002.1			
10 Micron filter alarm	<i>MBR_Filter_10_Flt</i>	40002.2			
3 Micron filter alarm	<i>MBR_Filter_3_Flt</i>	40002.3			
High Pressure alarm	<i>MBR_HP_Fault</i>	40002.4			
High water in separator	<i>MBR_HI_Wat_Lev_Flt</i>	40002.5			
Leak alarm	<i>MBR_Leak_Flt</i>	40002.6			
Motor Overload alarm	<i>MBR_OL_Flt</i>	40002.7			
Low Flow alarm	<i>MBR_Low_Flow</i>	40002.8			
Increase PLC Clock Minutes			MBW_Inc_Mins	40033.0	
Decrease PLC Clock Minutes			MBW_Dec_Mins	40033.1	
Increase PLC Clock Hours			MBW_Inc_Hrs	40033.2	
Decrease PLC Clock Hours			MBW_Dec_Hrs	40033.3	
Increase PLC Clock day of week			MBW_Inc_DOW	40033.4	
Decrease PLC Clock day of week			MBW_Dec_DOW	40033.5	
Increase tank number			MBW_Inc_Man	40033.6	
Decrease tank number			MBW_Dec_Man	40033.7	
Tank # to run on Sunday	<i>MBR_Sun_Tank</i>	40004	MBW_Sun_Tank	40034	1-TANKS
Tank # to run on Monday	<i>MBR_Mon_Tank</i>	40005	MBW_Mon_Tank	40035	1-TANKS
Tank # to run on Tuesday	<i>MBR_Tue_Tank</i>	40006	MBW_Tue_Tank	40036	1-TANKS
Tank # to run on Wednesday	<i>MBR_Wed_Tank</i>	40007	MBW_Wed_Tank	40037	1-TANKS
Tank # to run on Thursday	<i>MBR_Thu_Tank</i>	40008	MBW_Thu_Tank	40038	1-TANKS
Tank # to run on Friday	<i>MBR_Fri_Tank</i>	40009	MBW_Fri_Tank	40039	1-TANKS
Tank # to run on Saturday	<i>MBR_Sat_Tank</i>	40010	MBW_Sat_Tank	40040	1-TANKS
Set t# of tanks in system 1-4	<i>MBR_Tanks</i>	40011	MBW_Tanks	40041	1-4 (TANKS)
Adjust Low Flow alarm delay 1-5 minutes	<i>MBR_Lo_Flow_Limit</i>	40012	MBW_Lo_Flow_Limit	40042	1-5 Min.
Adjust Clock hours 0-23 hours	<i>MBR_Hr</i>	40013	MBW_Hr	40043	0-23
Adjust Clock minutes 0-59 minutes	<i>MBR_Min</i>	40014	MBW_Min	40044	0-59
Adjust day of week, 7 days (1=Sun thru 7= Sat)	<i>MBR_DOW</i>	40015	MBW_DOW	40045	Days 1-7 (1=Sun thru 7= Sat)

The table below indicates the READ and WRITE addresses for the various functional settings for the system.
 Note: (Modbus Write tags 40046-40048) a time value for seconds of 100 represents an actual time of 10.0 seconds (0.1 second time base).

TAG DESCRIPTIONS	MODBUS READ		MODBUS WRITE		
	Tag	Modbus Address	Tag	Modbus Address	Value Range
Adjust Fault / Alarms trip delay 1-90 seconds	<i>MBR_Flt_Delay</i>	40016	MBW_Flt_Delay	40046	1.0-90.0S
Adjust pump start delay 0-90 seconds	<i>MBR_Pump_Dly</i>	40017	MBW_Pump_Dly	40047	0.0-90.0S
Adjust valves to close delay 1-90 seconds	<i>MBR_Valve_Dly</i>	40018	MBW_Valve_Dly	40048	1.0-90.0S
Tank 1 run time hours	<i>MBR_T1_Hours</i>	40019	MBW_T1_Hours	40049	0-24
Tank 2 run time hours	<i>MBR_T2_Hours</i>	40020	MBW_T2_Hours	40050	0-24
Tank 3 run time hours	<i>MBR_T3_Hours</i>	40021	MBW_T3_Hours	40051	0-24
Tank 4 run time hours	<i>MBR_T4_Hours</i>	40022	MBW_T4_Hours	40052	0-24
Filtering start time Sundays	<i>MBR_Sun_Start_Hr</i>	40023	MBW_Sun_Start_Hr	40053	0-23
Filtering start time Mon-Fri	<i>MBR_Mon_Start_Hr</i>	40024	MBW_Mon_Start_Hr	40054	0-23
Filtering start time Saturday	<i>MBR_Sat_Start_Hr</i>	40025	MBW_Sat_Start_Hr	40055	0-23

Tag Descriptions	AUTO START FLAG				
	MODBUS READ		MODBUS WRITE		
	Tag	Modbus Address	Tag	Modbus Address	Value Range
Auto mode running	<i>MBR_Auto_On</i>	40001.0	MBW_Auto_On	40031.0	0-1

The system is put into AUTO mode by writing a 1 to address 40031.0
 Confirmation of the AUTO status can be read from 40001.0

Tag Descriptions	FAULT / ALARM RESET FLAG				
	MODBUS READ		MODBUS WRITE		
	Tag	Modbus Address	Tag	Modbus Address	Value Range
Reset alarms			MBW_Reset	40031.1	0-1

When a fault / alarm occurs in the PLC this be can remotely reset by writing a 1 to Modbus address 40031.1. Note this flag also acts as the Alarm Silence button.

Tag Descriptions	MANUAL ON/OFF FLAG and INC/DEC MAN FLAGS				
	MODBUS READ		MODBUS WRITE		
	Tag	Modbus Address	Tag	Modbus Address	Value Range
Turn on tank selected	<i>MBR_Manual_On_Off</i>	40001.3	MBW_Manual_On_Off	40031.3	
Increase tank #			MBW_Inc_Man	40033.6	
Decrease tank #			MBW_Dec_Man	40033.7	
Manual set tank #	<i>MBR_MANUAL_COUNT</i>	40026			

To start and stop the pump and the appropriate Tank # and Valves in a MANUAL mode (usually used for testing), utilize the INCREMENT or DECREMENT flags (Modbus addresses 40033.6 and 40033.7) to adjust the desired TANK NUMBER (1-4). Once the correct tank number is read at Modbus address 40026, write a 1 to the MANUAL ON/OFF flag (Modbus address 40001.3) and this will turn on the Pump and open the appropriate valves. To stop the manual operation repeat the write (value 1) to Modbus address 40001.3) this will toggle the functionality of the output.

Note the user must ensure that INC_MAN and DEC_MAN flags (Modbus addresses 40033.6 and 40033.7) are turned back to 0 after each write since the program utilizes positive edge transition to initiate the physical OFF to ON and ON to OFF transitions.

FAULT / ALARM ACTIVE FLAG					
Tag Descriptions	MODBUS READ		MODBUS WRITE		
	Tag	Modbus Address	Tag	Modbus Address	Value Range
General Fault / Alarm on	MBR_Fault_Active	40001.7			

Any Shutdown fault will be reported by the Fault / Alarm Active Flag (Modbus address 40001.7).

INDIVIDUAL ALARMS ACTIVE FLAG					
Tag descriptions	MODBUS READ		MODBUS WRITE		
	Tag	Modbus Address	Tag	Modbus Address	Value Range
Strainer/Vacuum alarm	MBR_Mesh_100_Flt	40002.0			
1 Micron filter alarm	MBR_Filter_1_Flt	40002.1			
10 Micron filter alarm	MBR_Filter_10_Flt	40002.2			
3 Micron filter alarm	MBR_Filter_3_Flt	40002.3			
High pressure alarm	MBR_HP_Fault	40002.4			
High Water alarm	MBR_HI_Wat_Lev_Flt	40002.5			
Leak Detector alarm	MBR_Leak_Flt	40002.6			
Motor Overload alarm	MBR_OL_Flt	40002.7			
Low Flow alarm	MBR_Low_Flow	40002.8			

Individual Fault / Alarms conditions can be monitored by reading Modbus addresses 40002.0 through 40002.8.

PRESSURE RELIEF ACTIVE FLAG					
Tag Descriptions	MODBUS READ		MODBUS WRITE		
	Tag	Modbus Address	Tag	Modbus Address	Value Range
Auto Pressure relief Active	MBR_P_Relief_On	40001.12			

During a Pressure Relief operation, the status can be read at Modbus flag 40001.12

PLC CLOCK ADJUSTMENT					
Tag Descriptions	MODBUS READ		MODBUS WRITE		
	Tag	Modbus Address	Tag	Modbus Address	Value Range
Increase Minutes			MBW_Inc_Mins	40033.0	
Decrease Minutes			MBW_Dec_Mins	40033.1	
Increase Hours			MBW_Inc_Hrs	40033.2	
Decrease Hours			MBW_Dec_Hrs	40033.3	
Increase day of week			MBW_Inc_DOW	40033.4	
Decrease day of week			MBW_Dec_DOW	40033.5	
Increase tank number			MBW_Inc_Man	40033.6	
Decrease tank number			MBW_Dec_Man	40033.7	

Modbus addresses 40033.0 through 40033.5 allow the user to increment or decrement the time of day clock inside the PLC. 40033.0 And 40033.1 Increment/decrement the Minutes, 40033.2 and 40033.3 Increment/decrement the Hours and 40033.4 and 40033.5 Increment/decrement the Day of Week.

PLC CLOCK VALUES					
Tag Descriptions	MODBUS READ		MODBUS WRITE		
	Tag	Modbus Address	Tag	Modbus Address	Value Range
Hours	MBR_Hr	40013	MBW_Hr	40043	0-23
Minutes	MBR_Min	40014	MBW_Min	40044	0-59
Day of Week	MBR_DOW	40015	MBW_DOW	40045	1-7

As an alternative to utilizing the INC/DEC function, the user can write values to the HOUR, MINUTES and DAY OF WEEK tags in the PLC directly by writing to Modbus addresses 40043, 40044 and 40045.

Note Valid write values for are as follows: -
 MINUTES: 0-59
 HOURS: 0-23
 DOW: 1-7 (Day of Week)

The user can also READ the current clock values from the PLC by reading Modbus addresses 40013, 40014 and 40015 (for HOUR, MINUTE and Day of Week respectively).

TANK NUMBER SETTINGS FOR EACH DAY					
Tag Descriptions	MODBUS READ		MODBUS WRITE		
	Tag	Modbus Address	Tag	Modbus Address	Value Range
Sunday tank # to run	MBR_Sun_Tank	40004	MBW_Sun_Tank	40034	1-TANKS
Monday tank # to run	MBR_Mon_Tank	40005	MBW_Mon_Tank	40035	1-TANKS
Tuesday tank # to run	MBR_Tue_Tank	40006	MBW_Tue_Tank	40036	1-TANKS
Wednesday tank # to run	MBR_Wed_Tank	40007	MBW_Wed_Tank	40037	1-TANKS
Thursday tank # to run	MBR_Thu_Tank	40008	MBW_Thu_Tank	40038	1-TANKS
Friday tank # to run	MBR_Fri_Tank	40009	MBW_Fri_Tank	40039	1-TANKS
Saturday tank # to run	MBR_Sat_Tank	40010	MBW_Sat_Tank	40040	1-TANKS
Set # of tanks in system	MBR_Tanks	40011	MBW_Tanks	40041	1-4 (TANKS)

The user can set up which tank to use for each day of the week by writing to Modbus addresses 40034 through 40040 (for days Sunday through Saturday respectively). Note, the maximum value that can be written to these addresses is determined by the value set at Modbus address 40011 (TANKS). The PLC program will ensure that the value set is minimum 1 and maximum 4.

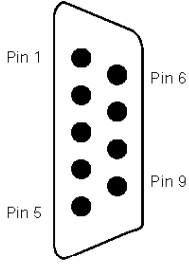
RUN TIME SETTINGS					
Tag Descriptions	MODBUS READ		MODBUS WRITE		
	Tag	Modbus Address	Tag	Modbus Address	Value Range
Low Flow settings 1-5 minutes. Default is 3 minutes	MBR_Lo_Flow_Limit	40012	MBW_Lo_Flow_Limit	40042	1-5 Min.
All alarms delay 1-90 seconds	MBR_Flt_Delay	40016	MBW_Flt_Delay	40046	1.0-90.0S
Pump Start delay 0-90 seconds	MBR_Pump_Dly	40017	MBW_Pump_Dly	40047	0.0-90.0S
All valves to close delay 1-90 seconds	MBR_Valve_Dly	40018	MBW_Valve_Dly	40048	1.0-90.0S
Tank 1 run time hours	MBR_T1_Hours	40019	MBW_T1_Hours	40049	0-24
Tank 2 run time hours	MBR_T2_Hours	40020	MBW_T2_Hours	40050	0-24
Tank 3 run time hours	MBR_T3_Hours	40021	MBW_T3_Hours	40051	0-24
Tank 4 run time hours	MBR_T4_Hours	40022	MBW_T4_Hours	40052	0-24
Sunday start time 0-23 hours	MBR_Sun_Start_Hr	40023	MBW_Sun_Start_Hr	40053	0-23
Mon-Fri start time 0-23 hours	MBR_Mon_Start_Hr	40024	MBW_Mon_Start_Hr	40054	0-23
Saturday start time 0-23 hours	MBR_Sat_Start_Hr	40025	MBW_Sat_Start_Hr	40055	0-23

The above table indicates the READ and WRITE addresses for the various functional settings for the system. Note: a time value for seconds of 100 represents an actual time of 10.0 seconds (0.1 second time base).

Connector Pin Assignments

The communications ports on the S7-200 CPU are RS-485 compatible on a nine-pin subminiature D connector in accordance with the PROFIBUS standard as defined in the European Standard EN 50170. Table 7-7 shows the connector that provides the physical connection for the communications port and describes the communications port pin assignments.

Table 7-7 Pin Assignments for the S7-200 Communications Port

Connector	Pin Number	PROFIBUS Signal	Port 0/Port 1
	1	Shield	Chassis ground
	2	24 V Return	Logic common
	3	RS-485 Signal B	RS-485 Signal B
	4	Request-to-Send	RTS (TTL)
	5	5 V Return	Logic common
	6	+5 V	+5 V, 100 Ω series resistor
	7	+24 V	+24 V
	8	RS-485 Signal A	RS-485 Signal A
	9	Not applicable	10-bit protocol select (input)
	Connector shell	Shield	Chassis ground

Biasing and Terminating the Network Cable

Siemens provides two types of network connectors that you can use to easily connect multiple devices to a network: a standard network connector (see Table 7-7 for the pin assignments), and a connector that includes a programming port, which allows you to connect a programming station or an HMI device to the network without disturbing any existing network connections. The programming port connector passes all signals (including the power pins) from the S7-200 through to the programming port, which is especially useful for connecting devices that draw power from the S7-200 (such as a TD 200).

Both connectors have two sets of terminal screws to allow you to attach the incoming and outgoing network cables. Both connectors also have switches to bias and terminate the network selectively. Figure 7-22 shows typical biasing and termination for the cable connectors.

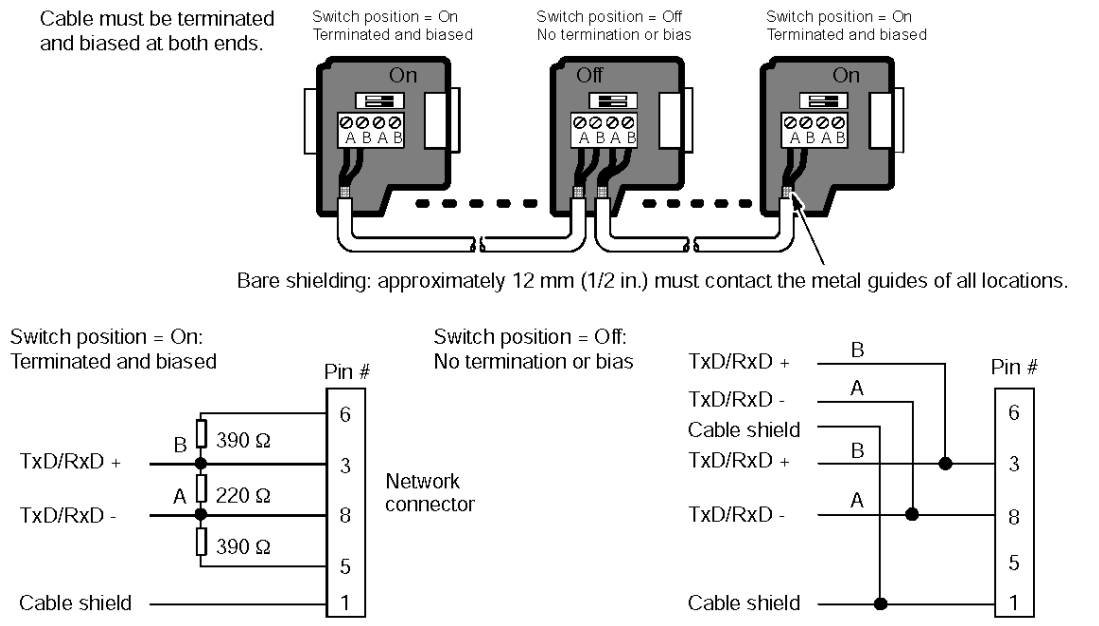


Figure 7-22 Bias and Termination of the Network Cable