Chapter 7
Modbus Communication

In this Chapter...

Modbus Protocol

All of the SOLO controllers have a 2-wire RS-485 serial communication port. The supported protocols are Modbus RTU and Modbus ASCII. The following communication port settings are possible.

	Protocol	
	Modbus RTU	***Modbus ASCII***
Network Address	***1*** to 247	
Baud Rate	2400, 4800, ***9600***, 19200, 38400 bps	
Bit Length	8 bits	***7***, 8 bits
Parity	None, ***Even***, Odd	
Stop Bit	***1***, 2 bits	

Bold Italic *text above represent default values in the SOLO controller.*

Registers

The SOLO controllers support two types of registers that are accessible through the Modbus communication.

- Data Registers
- Bit Registers

These registers support the following Modbus function codes.

Data Registers

03: Read Holding Registers (maximum limit is read of eight registers)
06: Write Single Register
16: Write Multiple Registers (maximum limit is eight)

Bit Registers

01: Read Coils
02: Read Discrete Inputs (Both Function Code 1 & 2 read the same memory area.)
05: Write SIngle Coil (Write FF00H to set the coil or 0000H to reset the coil.)

The following tables show all the Modbus addresses that are accessible through the Modbus network. For the details of each parameter, please refer to Chapter 3.

*Note: Make sure the On-Line Configuration parameter (*CoSH*, P3-12) is set to ON. The parameters in the SOLO controllers can be changed by the MODBUS network master only when the parameter is ON. (It is OFF as the factory default.)*

Data Registers						
ID	**Parameter Name**	**Description**	**R/W**	**Hexadecimal**	**Modbus Decimal**	**PLC Address (Octal)**
N/A	Process Value (PV)	If this register has one of the following values, it means there is an error: 8002H = Initial process (Temperature value is not yet available.) 8003H - Temperature sensor is not connected. 8004H = Temperature sensor input error 8006H = Cannot get temperature value, ADC input error 8007H Memory read / write error	R	1000	44097	V10000
N/A	Set Point Value (SV)	Unit is 0.1 (°C or °F)	R/W	1001	44098	V10001
P3-3	Input Range High	The data content should not be higher than the temperature range.	R/W	1002	44099	V10002
P3-4	Input Range Low	The data content should not be lower than the temperature range.	R/W	1003	44100	V10003
P3-1	Input Type	Please refer to the "Temperature Sensor Type and Temperature Range" table for details.	R/W	1004	44101	V10004
P3-5	Control Mode	0 = PID control 1 = On / Off control 2 = Manual control 3 = Ramp / Soak	R/W	1005	44102	V10005
P3-7	Heating / Cooling	0 = Heating 1 = Cooling 2 = Heating / Cooling 3 = Cooling / Heating	R/W	1006	44103	V10006
P1-11 P1-12	Output 1 Heating Period / Output 1 Cooling Period	0 = 0.5 sec 1 - 99 = 1 - 99 sec	R/W	1007	44104	V10007
P1-13	Output 2 Period	0 = 0.5 sec 1 - 99 = 1 - 99 sec	R/W	1008	44105	V10010
P1-4	Proportion Band	0.1 - 999.9	R/W	1009	44106	V10011
P1-5	Integral Time	0 - 9999	R/W	100A	44107	V10012
P1-6	Derivative Time	0 - 9999	R/W	100B	44108	V10013
P1-8	Integral Offset	0.0 - 100.0%	R/W	100C	44109	V10014
P1-7	PD Control Offset	0.0 - 100.0%	R/W	100D	44110	V10015
P1-14	Proportion Band Coefficient	0.01 - 99.99	R/W	100E	44111	V10016
P1-15	Dead Band	-999 - 9999	R/W	100F	44112	V10017

Data Registers cont.						
ID	Parameter Name	Description	R/W	Hexadecimal	Modbus Decimal	PLC Address (Octal)
P1-9	Output 1 Hysteresis	0 - 9999	R/W	1010	44113	V10020
P1-10	Output 2 Hysteresis	0 - 9999	R/W	1011	44114	V10021
P2-11	Output 1 Level	Unit is 0.1%, write operation is valid under manual tuning mode only.	R/W	1012	44115	V10022
P2-12	Output 2 Level	Unit is 0.1%, write operation is valid under manual tuning mode only.	R/W	1013	44116	V10023
P1-17	Analog High Adjustment	1 Unit = 2.8uA (Current Output) 1 Unit = 1.3 mV (Linear Voltage Output)	R/W	1014	44117	V10024
P1-18	Analog Low Adjustment	1 Unit = 2.8uA (Current Output) 1 Unit = 1.3 mV (Linear Voltage Output)	R/W	1015	44118	V10025
P1-16	PV Offset	-999 - 999	R/W	1016	44119	V10026
P2-3	Decimal Point Position	0 - 3	R/W	1017	44120	V10027
P1-2	PID Parameter Group	0 - 3 = PID parameter group 0 - 3. 4 = PID paramter group auto select	R/W	101C	44125	V10034
P1-3	Target SV	Only valid within available range, unit: 0.1 scale	R/W	101D	44126	V10035
P3-8	Alarm 1	0 = Alarm 1 is disabled. 1- 18 = Alarm type number	R/W	1020	44129	V10040
P3-9	Alarm 2	0 = Alarm 1 is disabled. 1- 18 = Alarm type number	R/W	1021	44130	V10041
P3-10	Alarm 3	0 = Alarm 1 is disabled. 1- 18 = Alarm type number	R/W	1022	44131	V10042
P3-11	System Alarm	0 = System Alarm is disabled. (default) 1 - 3 = Alarm number to also be used as system alarm.	R/W	1023	44132	V10043
P2-4	Alarm 1 High Limit	Please refer to the contents of the “Alarm Outputs” for details.	R/W	1024	44133	V10044
P2-5	Alarm 1 low Limit	Please refer to the contents of the “Alarm Outputs” for details.	R/W	1025	44134	V10045
P2-6	Alarm 2 High Limit	Please refer to the contents of the “Alarm Outputs” for details.	R/W	1026	44135	V10046
P2-7	Alarm 2 Low Limit	Please refer to the contents of the “Alarm Outputs” for details.	R/W	1027	44136	V10047

Data Registers cont.						
ID	**Parameter Name**	**Description**	**R/W**	**Hexadecimal**	**Modbus Decimal**	**PLC Address (Octal)**
P2-8	Alarm 3 High Limit	Please refer to the contents of the “Alarm Outputs” for details.	R/W	1028	44137	V10050
P2-9	Alarm 3 Low Limit	Please refer to the contents of the “Alarm Outputs” for details.	R/W	1029	44138	V10051
N/A	LED Status	Bit 0 = ALM3 Bit 1 = ALM2 Bit 2 = °F Bit 3 = °C Bit 4 = ALM1 Bit 5 = OUT2 Bit 6 = OUT1 Bit 7 = AT	R	102A	44139	V10052
N/A	Pushbutton Status	Bit 0 = SET Bit 1 = Rotate Bit 2 = Up Bit 3 = Down If the button is pressed, the bit is off.	R	102B	44140	V10053
P2-10	Lock Mode	0 = OFF 1 = Lock Mode 1 11 - Lock Mode 2	R/W	102C	44141	V10054
N/A	Firmware Version	V1.00 indicates 0x100	R	102F	44144	V10057
P2-2	Starting Ramp / Soak Pattern	0 - 7	R/W	1030	44145	V10060
P3-21	Last Step Number	0 - 7 = The last step number of the pattern	R/W	1040~ 1047*	44161~ 44168*	V10100~ V10107*
P3-22	Additional Cycles	0 - 199	R/W	1050~ 1057*	44177~ 44184*	V10120~ V10127*
P3-23	Next Pattern Number	0 - 7 = Next pattern number 8 = There is no next pattern.	R/W	1060~ 1067*	44193~ 44200*	V10140~ V10147*
P3-19	Ramp / Soak SV	-999 - 9999	R/W	2000~ 203F*	48193~ 48256*	V20000~ V20077*
P3-20	Ramp / Soak Time	0 - 1500 (15 hours 0 minutes)	R/W	2080~ 20BF*	48321~ 48384*	V20200~ V20277*

**Note: The Appendix covers the Modbus address map for the Ramp / Soak Control.*

Bit Registers						
ID	Parameter Name	Description	R/W	Hexadecimal	Modbus Decimal	PLC Address (Octal)
N/A	AT LED status	0 = Off, 1 = On	R	0800	2049	Y0
N/A	Output 1 LED status	0 = Off, 1 = On	R	0801	2050	Y1
N/A	Output 2 LED status	0 = Off, 1 = On	R	0802	2051	Y2
N/A	Alarm 1 LED status	0 = Off, 1 = On	R	0803	2052	Y3
N/A	°F LED status	0 = Off, 1 = On	R	0804	2053	Y4
N/A	°C LED status	0 = Off, 1 = On	R	0805	2054	Y5
N/A	Alarm 2 LED status	0 = Off, 1 = On	R	0806	2055	Y6
N/A	Alarm 3 LED status	0 = Off, 1 = On	R	0807	2056	Y7
N/A	SET key status	0 = Pressed, 1 = Not Pressed	R	0808	2057	Y10
N/A	Function key status	0 = Pressed, 1 = Not Pressed	R	0809	2058	Y11
N/A	UP key status	0 = Pressed, 1 = Not Pressed	R	080A	2059	Y12
N/A	DOWN key status	0 = Pressed, 1 = Not Pressed	R	080B	2060	Y13
N/A	Event 1 input status	0 = Disabled, 1 = Enabled	R	080C	2061	Y14
N/A	Event 2 input status	0 = Disabled, 1 = Enabled	R	080D	2062	Y15
N/A	System Alarm Status	0 = Off, 1 = On	R	080E	2063	Y16
N/A	Ramp / Soak Control status	0 = Ramp / Soak disabled 1 = Ramp / Soak enabled	R	080F	2064	Y17
P3-12	On-Line Configuration	0 = On-Line Configuration is disabled (default) 1 = On-Line Configuration is enabled	R/W	0810	2065	Y20
N/A	Temperature Unit Display Selection	0 = °F 1 = °C / Linear input (default)	R/W	0811	2066	Y21
P2-3	Decimal Point Display Selection	0 = No decimal 1 = 10ths digit decimal (B, S and R type thermocouples use only 0 decimal display.	R/W	0812	2067	Y22
P1-1	Auto Tuning	0 = Off (default) 1 = On	R/W	0813	2068	Y23
P2-1	Run / Stop the Control	0 = STOP 1 = RUN (default)	R/W	0814	2069	Y24
P2-1	Stop the Ramp / Soak Control	0 = RUN (default) 1 = STOP	R/W	0815	2070	Y25
P2-1	Hold the Ramp / Soak Control	0 = RUN (default) 1 = HOLD	R/W	0816	2071	Y26

Temperature Sensor Type and Temperature Range			
Hex - Address 1004			
Input Sensor type	**Register Value**	**Display**	**Temperature Range**
0 ~ 50 mV Analog Input	17		-999 ~ 9999
4 ~ 20 mA Input	16		-999 ~ 9999
0 ~ 20 mA Input	15		-999 ~ 9999
0 ~ 10 VDC Input	14		-999 ~ 9999
0 ~ 5 VDC Input	13		-999 ~ 9999
RTD (Pt100) type	12		-328 ~ 1112°F (-200 ~ 600°C)
RTD (JPt100) type	11		-4 ~ 752°F (-20 ~ 400°C)
Thermocouple TXK type	10		-328 ~ 1472°F (-200 ~ 800°C)
Thermocouple U type	9		-328 ~ 932°F (-200 ~ 500°C)
Thermocouple L type	8		-328 ~ 1562°F (-200 ~ 850°C)
Thermocouple B type	7		212 ~ 3272°F (100 ~ 1800°C)
Thermocouple S type	6		32 ~ 3092°F (0 ~ 1700°C)
Thermocouple R type	5		32 ~ 3092°F (0 ~ 1700°C)
Thermocouple N type	4		-328 ~ 2372°F (-200 ~ 1300°C)
Thermocouple E type	3		32 ~ 1112°F (0 ~ 600°C)
Thermocouple T type	2		-328 ~ 752°F (-200 ~ 400°C)
Thermocouple J type	1		-148 ~ 2192°F (-100 ~ 1200°C)
Thermocouple K type	0		-328 ~ 2372°F (-200 ~ 1300°C)

Connection with the DirectLOGIC PLC

The following DirectLOGIC PLCs can communicate with the SOLO controller. The DL06 or D2-260 PLCs are preferred for connection with the SOLO controller because they have a built in RS-485 communication port support function code 05.

DirectLogic PLC	Com port	Restriction	Instructions to use	Wiring Diagram
DL05	Port 2 + FA-ISOCON	Can't write to the bit registers because the DL05 does not support the function code 05. Modbus RTU only	RX, WX	Figure 1
	D0-DCM Port2	Can't write to the bit registers if installed in the DL05 because the DL05 does not support the function code 05. Modbus RTU only.	RX, WX	Figure 2
DL06	Port 2	Modbus RTU only	MRX, MWX	Figure 2
	D0-DCM Port2	Modbus RTU only	MRX, MWX	Figure 2
D2-250-1	Port 2 + FA-ISOCON +FA-15HD	Can't write to the bit registers because the D2-250-1 does not support the function code 05.	RX, WX	Figure 3
D2-260	Port 2	Modbus RTU only	MRX, MWX	Figure 2
D3-350	Port 2 + FA-ISOCON	Can't write to the bit registers because the D3-350 does not support the function code 05. Modbus RTU only.	RX, WX	Figure 4
D4-450	Port 1 + FA-ISOCON	Can't write to the bit registers because the D4-450 does not support the function code 05. Modbus RTU only.	RX, WX	Figure 5

Figure 1

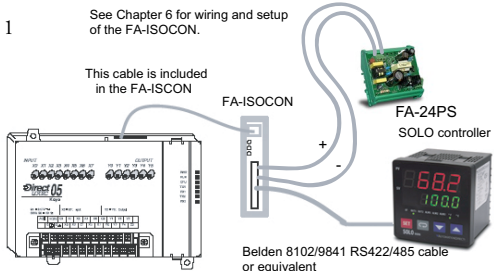


Figure 2

You will need to make this custom cable

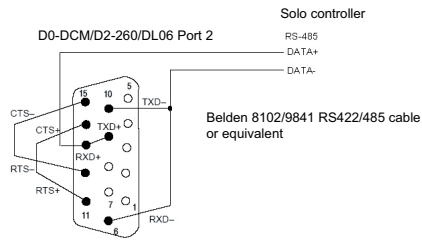


Figure 3

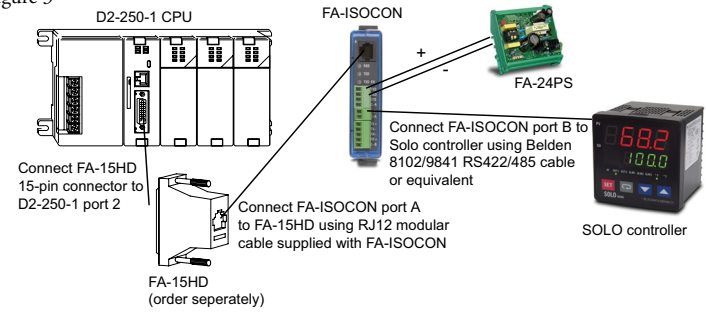


Figure 4

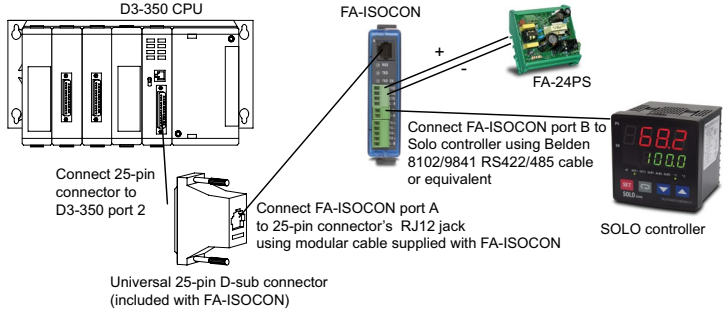
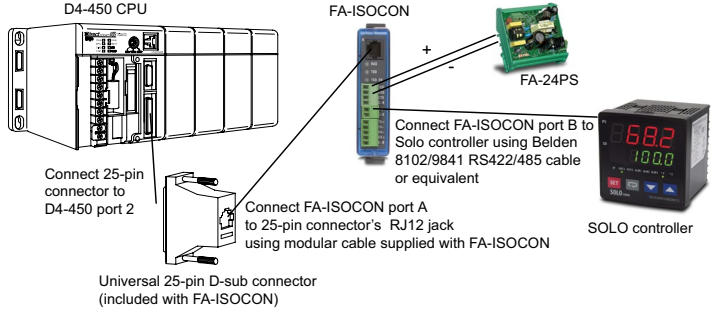
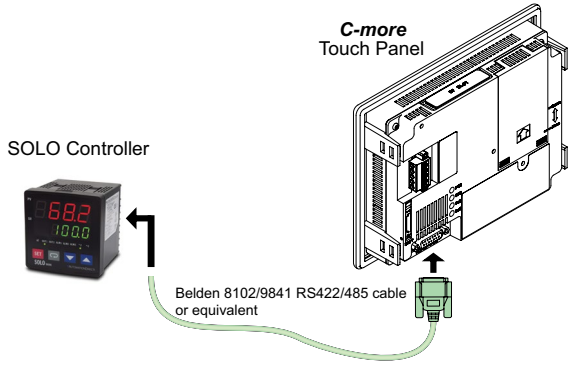


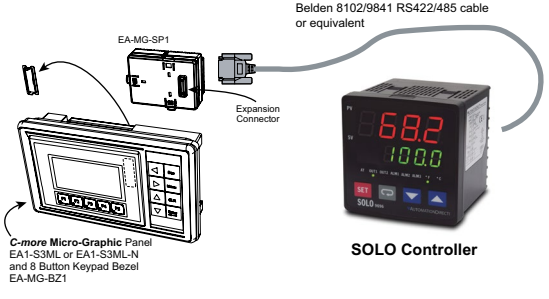
Figure 5



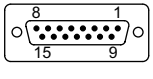
Connection with the C-more and C-more Micro HMI panels

Any of the ***C-more*** and ***C-more*** Micro-Graphic HMI panels can be connected to the SOLO controllers. The ***C-more*** HMI panels have a built in RS-485 port. The ***C-more*** 3" Micro-Graphic panels require an optional module (EA-MG-SP1).





Serial Communications



Pin	Signal	Pin	Signal	Pin	Signal
1	Frame GND	6	LE	11	TXD+ (422/485)
2	TXD (232C)	7	CTS (232C)	12	TXD– (422/485)
3	RXD (232C)	8	RTS (232C)	13	Term. Resistor
4	Vcc	9	RXD+ (422/485)	14	do not use
5	Logic GND	10	RXD– (422/485)	15	do not use

C-more and ***C-more*** Micro-Graphic Panel RS-485 port