Network Communication

The device parameters must be set before connection to the network and will ensure each device will have a unique ModBus address for startup. Details of the device setup can be found in the User Menu section. Once set, all parameters are saved in non-volatile memory. The local menu and LCD are used to set the ModBus device address (1-255) and the baud rate. The factory defaults are address 01 and 9600 baud.

The menu is also used to select RTU/ASCII mode, the parity, number of stop bits, the CRC value and ModBus delay values so the device can be completely configured for the communication parameters before being connecting to the network.

Modbus Trouble-shooting

The CO Transmitter operates as a slave. It will not communicate unless a master is connected to the network and sends a request for information, then the slave will answer. If the device does not communicate properly, first check that the communication wires are not reversed. Then check the communication parameters in the menu in the following sequence: Slave address, baud rate, transmission mode, parity bit, stop bit, RTU mode CRC polynomial and slave response delay.

The factory default Modbus address is 01 and each device must have its unique address to communicate properly on the bus. Use the menu to change the Slave address to a unique number for each unit.

The default Modbus baud rate is 9600. Use the menu to change the baud rate to the correct setting.

The default transmission mode is RTU. If this is incorrect, use the menu to change the transmission mode to ASCII.

The default Modbus parity is None. If this is not correct, use the menu to change the parity from None to Odd or Even.

The default stop bits is 1. Use the menu to change the stop bit setting to 2. For some configurations the value is fixed.

The default Modbus CRC value is A001. The menu can be used to change this setting. This only applies to RTU mode and has no effect in ASCII mode. It is the CRC polynomial setting and can be changed between A001, 1021, 8005 or 8408.

The default Modbus delay is minimum (0). This can be changed in the menu. It is the slave response delay and can be set from minimum to 350ms. For example, the minimum delay means 3.5 character time delays or 4ms for 9600 baud rate.

ModBus Protocol

This section describes the implementation of the Modbus protocol used in the CO Transmitter. It is intended to assist control system programmers who may need to add support to their systems to communicate with this device. The CO Transmitter communicates on standard Modbus networks using either RTU or ASCII mode transmission. It operates as a slave device (address from 01 to 255) and expects a Modbus master device to transmit queries, which it will answer.

RTU Mode Message Format

Modbus Framing	8 bit binary
Data Bits	start bits --- 1 data bits --- 8 parity bits --- none, odd or even stop bits --- 1or 2
Baud Rate	300, 600, 1200, 2400, 4800, 9600 or 19200
Duplex	Half duplex
Error Checking	Cyclical Redundancy Check (CRC) CRC-16 --- polynomial x16+x15+x2+x0 0x8005 or reversed version 0xA001 or CRC-CITT --- polynomial x16+x12+x5+x0 0x1021 or reversed version 0x8408
Latency	More than 3.5 characters --- minimum, 50, 100, 150, 200, 250, 300 or 350 mS

ASCII Mode Message Format

Modbus Framing	ASCII characters 0…9, A…F
Data Bits	start bits --- 1 data bits --- 7 parity bits --- none, odd or even stop bits --- 1or 2
Baud Rate	300, 600, 1200, 2400, 4800, 9600 or 19200
Duplex	Half duplex
Error Checking	Longitudinal Redundancy Check (LRC)
Latency	More than 3.5 characters --- minimum, 50, 100, 150, 200, 250, 300 or 350 mS

Framing Support and Bit Sequences

RTU Mode	Start	1	2	3	4	5	6	7	8	Stop	
	Start	1	2	3	4	5	6	7	8	Stop	Stop
	Start	1	2	3	4	5	6	7	8	Odd	Stop
	Start	1	2	3	4	5	6	7	8	Even	Stop
ASCII Mode	Start	1	2	3	4	5	6	7	Stop	Stop	
	Start	1	2	3	4	5	6	7	Odd	Stop	
	Start	1	2	3	4	5	6	7	Odd	Stop	Stop
	Start	1	2	3	4	5	6	7	Even	Stop	
	Start	1	2	3	4	5	6	7	Even	Stop	Stop

Modbus Register Addressing

Modbus Address	Typical Offset	Units	Data Type	Access	Notes
40001	+0		Word	Read	Unsigned 16-bit integer 0x0000 = CO in normal status, 0x0001 = in abnormal status
40002	+1	PPM	Word	Read	Unsigned 16-bit integer, CO value
40003	+2	°F/°C	Word	Read	Unsigned 16-bit integer, Temperature value x 10 (the application program must divide the value by 10) (For example: 214 = 21.4 °C) (0-50 °C / 32-122 °F range)
40004	+3		Word	Read	Unsigned 16-bit integer 0x0000 = buzzer not activated, 0x0001 = buzzer activated
40005	+4		Word	Read	Unsigned 16-bit integer 0x0000 = relay1 not activated, 0x0001 = relay1 activated
40006	+5		Word	Read	Unsigned 16-bit integer 0x0000 = relay2 not activated, 0x0001 = relay2 activated
40007	+6		Word	Read	Unsigned 16-bit integer 0x0000 = test not activated, 0x0001 = test activated
40008	+7		Word	Read	Unsigned 16-bit integer 0x0000 = fault not activated, 0x0001 = fault activated

40009	+8		Word	Write	Unsigned 16-bit integer 0x0000 = Buzzer Disable, 0x0001 = Buzzer Enable
40010	+9		Word	Write	Unsigned 16-bit integer, BUZZER_TRIP = 0 to 0x0030 TRIP = 20 + 10 * (BUZZER_TRIP) = 20 to 500 ppm
40011	+10	MIN	Word	Write	Unsigned 16-bit integer, BUZZER_DELAY = 0 to 0x000A DELAY = BUZZER_DELAY = 0 to 10 minutes
40012	+11		Word	Write	Unsigned 16-bit integer, RELAY1_TRIP = 0 to 0x0030 TRIP = 20 + 10 * (RELAY1_TRIP) = 20 to 500 ppm
40013	+12		Word	Write	Unsigned 16-bit integer, RELAY1_HYST = 0 to 0x0012 HYST = 10 + 5 * (RELAY1_HYST) = 10 to 100 ppm
40014	+13	MIN	Word	Write	Unsigned 16-bit integer, RELAY1_DELAY = 0 to 0x000A DELAY = RELAY1_DELAY = 0 to 10 minutes
40015	+14		Word	Write	Unsigned 16-bit integer, RELAY2_TRIP = 0 to 0x0030 TRIP = 20 + 10 * (RELAY2_TRIP) = 20 to 500 ppm
40016	+15		Word	Write	Unsigned 16-bit integer, RELAY2_HYST = 0 to 0x0012 HYST = 10 + 5 * (RELAY2_HYST) = 10 to 100 ppm
40017	+16	MIN	Word	Write	Unsigned 16-bit integer, RELAY2_DELAY = 0 to 0x000A DELAY = RELAY2_DELAY = 0 to 10 minutes
40018	+17		Word	Write	Unsigned 16-bit integer 0x0000 = Test Mode Disable, 0x0001 = Test Mode Enable
40019	+18		Word	Write	Unsigned 16-bit integer, TEST_TIME = 0 to 0x000E TIME = 1 + (TEST_TIME) = 1 to 15 minutes
40020	+19		Word	Write	Unsigned 16-bit integer 0x0000 = Fault Mode Disable, 0x0001 = Fault Mode Enable 0x0002 = Fault Mode Reset, Revert to Disable
40021	+20		Word	Write	Unsigned 16-bit integer, FAULT_TIME = 0 to 0x0003 TIME = 3 + (FAULT_TIME) = 3 to 6 years
40022	+21		Word	Write	Unsigned 16-bit integer 0x0000 = Status Display, 0x0001 = CO Value Display
40023	+22		Word	Write	Unsigned 16-bit integer 0x0000 = Backlight Disable, 0x0001 = Backlight Enable
40024	+23		Word	Write	Unsigned 16-bit integer, OUT_TEST = 0 to 0x0006 OUT = 0(OFF), 1(4mA), 2(8mA), 3(12mA), 4(16mA), 5=6(20mA) or OUT = 0(OFF), 1(0V), 2(1V), 3(2V), 4(3V), 5(4V), 6(5V) or OUT = 0(OFF), 1(0V), 2(2V), 3(4V), 4(6V), 5(8V), 6(10V)
40025	+24		Word	Write	Unsigned 16-bit integer 0x0000 = ReCal Mode Disable, 0x0001 = ReCal Mode Enable 0x0002 = ReCal Mode Reset, Revert to Enable
40026	+25		Word	Write	Unsigned 16-bit integer, ReCal_TIME = 0 to 0x0002 TIME = 1 + (ReCal_TIME) = 1 to 3 years
40027	+26		Word	Write	Unsigned 16-bit integer 0 = °C, 1 = °F
40028	+27	°C/°F	Word	Write	Unsigned 16-bit integer, TEMPERATURE_OFFSET = 0 to 0x14 C_OFFSET = TEMPERATURE_OFFSET / 2 - 5 = -5.0 to 5.0 °C F_OFFSET = TEMPERATURE_OFFSET - 10 = -10 to 10 °F

Function Codes (RTU mode)

0x03 --- Read holding registers

Query

Slave address (0x01 to 0xFF)	Function code (0x03)	Starting address MSB	Starting address LSB	Quantity of registers MSB	Quantity of registers LSB	CRC LSB	CRC MSB

* Starting address = 0x0000 to 0xFFFF, Quantity of registers = 0x0000 to 0x007D

Response

Slave address (0x01 to 0xFF)	Function code (0x03)	Byte count 2N	Register value MSB	Register value LSB	…	CRC LSB	CRC MSB

* N= Quantity of registers

0x06 --- Write single register

Query

Slave address (0x01 to 0xFF)	Function code 0x06	Register address MSB	Register address LSB	Register value MSB	Register value LSB	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	Function code 0x06	Register address MSB	Register address LSB	Register value MSB	Register value LSB	CRC LSB	CRC MSB

* Register address = 0x0000 to 0xFFFF, Registers value = 0x0000 to 0xFFFF

Exception response

Slave address (0x01 to 0xFF)	Function code + 0x80	Exception code 0x01, 0x02 or 0x03	CRC LSB	CRC MSB

* An exception response is only returned if the CRC is correct
  Exception code 01 --- illegal function, 02 --- illegal address, 03 --- illegal data value

The RTU function codes supported by the CO Transmitter are shown below.

0x03 --- Read CO Status

Query

Slave address (0x01 to 0xFF)	0x03	0x00	0x00	0x00	0x01	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x03	0x02	Register value 0x00	Register value LSB	CRC LSB	CRC MSB

* Register value = 0x0000 in normal status, 0x0001 in abnormal status

0x03 --- Read CO PPM

Query

Slave address (0x01 to 0xFF)	0x03	0x00	0x01	0x00	0x01	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x03	0x02	Register value MSB (PPM)	Register value LSB (PPM)	CRC LSB	CRC MSB

* Register value = 0x0000 to 0x01F4, corresponding to 0 to 500 ppm

0x03 --- Read Temperature

Query

Slave address (0x01 to 0xFF)	0x03	0x00	0x02	0x00	0x01	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x03	0x02	Register value 0x00	Register value (C/F x 10)	CRC LSB	CRC MSB

0x03 --- Read Buzzer Status

Query

Slave address (0x01 to 0xFF)	0x03	0x00	0x03	0x00	0x01	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x03	0x02	Register value 0x00	Register value LSB	CRC LSB	CRC MSB

* Register value = 0x0000 = buzzer not activated, 0x0001 = buzzer activated

0x03 --- Read Relay 1 Status

Query

Slave address (0x01 to 0xFF)	0x03	0x00	0x04	0x00	0x01	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x03	0x02	Register value 0x00	Register value LSB	CRC LSB	CRC MSB

* Register value = 0x0000 = relay 1 not activated, 0x0001 = relay 1 activated

0x03 --- Read Relay 2 Status

Query

Slave address (0x01 to 0xFF)	0x03	0x00	0x05	0x00	0x01	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x03	0x02	Register value 0x00	Register value LSB	CRC LSB	CRC MSB

* Register value = 0x0000 = relay 2 not activated, 0x0001 = relay 2 activated

0x03 --- Read Test Mode Status

Query

Slave address (0x01 to 0xFF)	0x03	0x00	0x06	0x00	0x01	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x03	0x02	Register value 0x00	Register value LSB	CRC LSB	CRC MSB

* Register value = 0x0000 = test mode not activated, 0x0001 = test mode activated

0x03 --- Read Fault Mode Status

Query

Slave address (0x01 to 0xFF)	0x03	0x00	0x07	0x00	0x01	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x03	0x02	Register value 0x00	Register value LSB	CRC LSB	CRC MSB

* Register value = 0x0000 = fault mode not activated, 0x0001 = fault mode activated

0x06 --- Write single register (BUZZER_ENABLE)

Query

Slave address (0x01 to 0xFF)	0x06	0x00	0x08	0x00	Register value LSB	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x06	0x00	0x08	0x00	Register value LSB	CRC LSB	CRC MSB

* Register value = 0x0000 = buzzer disable, 0x0001 = buzzer enable

0x06 --- Write single register (BUZZER_TRIP)

Query

Slave address (0x01 to 0xFF)	0x06	0x00	0x09	0x00	Register value LSB	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x06	0x00	0x09	0x00	Register value LSB	CRC LSB	CRC MSB

* Register value = 0x0000 to 0x0030, corresponding to 20 to 500 ppm, TRIP = 20 + 10 * (BUZZER_TRIP)

0x06 --- Write single register (BUZZER_DELAY)

Query

Slave address (0x01 to 0xFF)	0x06	0x00	0x0A	0x00	Register value LSB	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x06	0x00	0x0A	0x00	Register value LSB	CRC LSB	CRC MSB

* Register value = 0x0000 to 0x000A, corresponding to 0 to 10 minutes

0x06 --- Write single register (RELAY1_TRIP)

Query

Slave address (0x01 to 0xFF)	0x06	0x00	0x0B	0x00	Register value LSB	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x06	0x00	0x0B	0x00	Register value LSB	CRC LSB	CRC MSB

* Register value = 0x0000 to 0x0030, corresponding to 20 to 500 ppm, TRIP = 20 + 10 * (RELAY1_TRIP)

0x06 --- Write single register (RELAY1_HYST)

Query

Slave address (0x01 to 0xFF)	0x06	0x00	0x0C	0x00	Register value LSB	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x06	0x00	0x0C	0x00	Register value LSB	CRC LSB	CRC MSB

* Register value = 0x0000 to 0x0012, corresponding to 10 to 100 ppm, HYST = 10 + 5 * (RELAY1_HYST)

0x06 --- Write single register (RELAY1_DELAY)

Query

Slave address (0x01 to 0xFF)	0x06	0x00	0x0D	0x00	Register value LSB	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x06	0x00	0x0D	0x00	Register value LSB	CRC LSB	CRC MSB

* Register value = 0x0000 to 0x000A, corresponding to 0 to 10 minutes

0x06 --- Write single register (RELAY2_TRIP)

Query

Slave address (0x01 to 0xFF)	0x06	0x00	0x0E	0x00	Register value LSB	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x06	0x00	0x0E	0x00	Register value LSB	CRC LSB	CRC MSB

* Register value = 0x0000 to 0x0030, corresponding to 20 to 500 ppm, TRIP = 20 + 10 * (RELAY2_TRIP)

0x06 --- Write single register (RELAY2_HYST)

Query

Slave address (0x01 to 0xFF)	0x06	0x00	0x0F	0x00	Register value LSB	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x06	0x00	0x0F	0x00	Register value LSB	CRC LSB	CRC MSB

* Register value = 0x0000 to 0x0012, corresponding to 10 to 100 ppm, HYST = 10 + 5 * (RELAY2_HYST)

0x06 --- Write single register (RELAY2_DELAY)

Query

Slave address (0x01 to 0xFF)	0x06	0x00	0x10	0x00	Register value LSB	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x06	0x00	0x10	0x00	Register value LSB	CRC LSB	CRC MSB

* Register value = 0x0000 to 0x000A, corresponding to 0 to 10 minutes

0x06 --- Write single register (TEST_MODE_ENABLE)

Query

Slave address (0x01 to 0xFF)	0x06	0x00	0x11	0x00	Register value LSB	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x06	0x00	0x11	0x00	Register value LSB	CRC LSB	CRC MSB

* Register value = 0x0000 = test mode disable, 0x0001 = test mode enable

0x06 --- Write single register (TEST_TIME)

Query

Slave address (0x01 to 0xFF)	0x06	0x00	0x12	0x00	Register value LSB	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x06	0x00	0x12	0x00	Register value LSB	CRC LSB	CRC MSB

* Register value = 0x0000 to 0x000E, corresponding to 1 to 15 minutes, TIME = 1 + (TEST_TIME)

0x06 --- Write single register (FAULT_MODE_ENABLE)

Query

Slave address (0x01 to 0xFF)	0x06	0x00	0x13	0x00	Register value LSB	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x06	0x00	0x13	0x00	Register value LSB	CRC LSB	CRC MSB

* Register value = 0x0000 = fault mode disable, 0x0001 = fault mode enable, 0x0002 = fault mode reset, revert to disable

0x06 --- Write single register (FAULT_TIME)

Query

Slave address (0x01 to 0xFF)	0x06	0x00	0x14	0x00	Register value LSB	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x06	0x00	0x14	0x00	Register value LSB	CRC LSB	CRC MSB

* Register value = 0x0000 to 0x0003, corresponding to 3 to 6 years, TIME = 3 + (FAULT_TIME)

0x06 --- Write single register (DISPLAY_MODE)

Query

Slave address (0x01 to 0xFF)	0x06	0x00	0x15	0x00	Register value LSB	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x06	0x00	0x15	0x00	Register value LSB	CRC LSB	CRC MSB

* Register value = 0x0000 = status display, 0x0001 = CO value display

0x06 --- Write single register (BACKLIGHT_ENABLE)

Query

Slave address (0x01 to 0xFF)	0x06	0x00	0x16	0x00	Register value LSB	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x06	0x00	0x16	0x00	Register value LSB	CRC LSB	CRC MSB

* Register value = 0x0000 = backlight disable, 0x0001 = backlight enable

0x06 --- Write single register (OUTPUT_TEST)

Query

Slave address (0x01 to 0xFF)	0x06	0x00	0x17	0x00	Register value LSB*	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x06	0x00	0x17	0x00	Register value LSB*	CRC LSB	CRC MSB

* Registers value = 0x0000 to 0x0006, corresponding to the output signal level (depends on output setting)
OUT = 0(OFF), 1(0V), 2(1V), 3(2V), 4(3V), 5(4V), 6(5V) for 0-5 Vdc output
OUT = 0(OFF), 1(0V), 2(2V), 3(4V), 4(6V), 5(8V), 6(10V) for 0-10 Vdc output
OUT = 0(OFF), 1(4mA), 2(8mA), 3(12mA), 4(16mA), 5(20mA), 6(20mA) for 4-20 mA output

0x06 --- Write single register (RECAL_MODE_ENABLE)

Query

Slave address (0x01 to 0xFF)	0x06	0x00	0x18	0x00	Register value LSB	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x06	0x00	0x18	0x00	Register value LSB	CRC LSB	CRC MSB

* Register value = 0x0000 = ReCal mode disable, 0x0001 = ReCal mode enable, 0x0002 = ReCal mode reset, revert to enable

0x06 --- Write single register (RECAL_TIME)

Query

Slave address (0x01 to 0xFF)	0x06	0x00	0x19	0x00	Register value LSB	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x06	0x00	0x19	0x00	Register value LSB	CRC LSB	CRC MSB

* Register value = 0x0000 to 0x0002, corresponding to 1 to 3 years, TIME = 1 + (RECAL_TIME)

0x06 --- Write single register (C/F)

Query

Slave address (0x01 to 0xFF)	0x06	0x00	0x1A	0x00	Register value LSB*	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x06	0x00	0x1A	0x00	Register value LSB*	CRC LSB	CRC MSB

* Registers value = 0x0000 to 0x0001, corresponding to 0 = C and 1 = F

0x06 --- Write TEMPERATURE_OFFSET

Query

Slave address (0x01 to 0xFF)	0x06	0x00	0x1B	0x00	Register value LSB	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x06	0x00	0x1B	0x00	Register value LSB	CRC LSB	CRC MSB

* This register is used to add or subtract an offset to the temperature value if necessary to conform to a local reference.

Register value = 0x0000 to 0x0014

For °C operation, this corresponds to T_OFFSET / 2 - 5 = -5.0 to 5.0 °C. ie: 0x0003 => 3/2 - 5 = -3.5 °C offset.

For °F operation, this corresponds to T_OFFSET - 10 = -10 to 10 °F. ie: 0x0003 => 3 - 10 = -7 °F offset.

The operating temperature units (°C or °F) for the device should be selected first, and then add any offset if necessary.

Exception response

Slave address (0x01 to 0xFF)	Function code + 0x80	Exception code * 0x01, 0x02 or 0x03	CRC LSB	CRC MSB

* An exception response is only returned if the CRC is correct

Exception code 01 --- illegal function, 02 --- illegal address, 03 --- illegal data value

Function codes (ASCII mode)

0x03 --- Read holding registers

Query

Start character (:) 0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	Function code (0x03) MSB (0x30)	Function code (0x03) LSB (0x33)	Starting address MSB	Starting address	Starting address	Starting address LSB
Quantity of registers MSB	Quantity of registers	Quantity of registers	Quantity of registers LSB	LRC MSB	LRC LSB	Return-line feed (CRLF) 0x0D	Return-line feed (CRLF) 0x0A	

* Starting address = 0x0000 to 0xFFFF, Quantity of registers = 0x0000 to 0x007D

Response

Start character (:) 0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	Function code (0x03) MSB (0x30)	Function code (0x03) LSB (0x33)	Byte count MSB (N)	Byte count LSB (N)	
Register value MSB	Register value	Register value	Register value LSB	LRC MSB	LRC LSB	Return-line feed (CRLF) 0x0D	Return-line feed (CRLF) 0x0A

* N= Quantity of registers

0x06 --- Write single register

Query

Start character (:) 0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	Function Code (0x06) MSB (0x30)	Function Code (0x06) LSB (0x36)	Register address MSB	Register address	Register address	Register address LSB
Register value MSB	Register value	Register value	Register value LSB	LRC MSB	LRC LSB	Return-line feed (CRLF) 0x0D	Return-line feed (CRLF) 0x0A	

* Register address = 0x0000 to 0xFFFF, Registers value = 0x0000 to 0xFFFF

Response

Start character (:) 0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	Function Code (0x06) MSB (0x30)	Function Code (0x06) LSB (0x36)	Register address MSB	Register address	Register address	Register address LSB
Register value MSB	Register value	Register value	Register value LSB	LRC MSB	LRC LSB	Return-line feed (CRLF) 0x0D	Return-line feed (CRLF) 0x0A	

Exception response

Start character (:) 0x3A	Slave address (0x01 to 0xFF) MSB	Slave address (0x01 to 0xFF) LSB	Function Code + 0x80 MSB	Function Code + 0x80 LSB	Exception code 0x30
Exception code 0x01, 0x02 or 0x03 (0x31, 0x32 or 0x33)			LRC MSB	LRC LSB	Return-line feed (CRLF) 0x0D	Return-line feed (CRLF) 0x0A

* An exception response is only returned if the LRC is correct
Exception code 01 --- illegal function, 02 --- illegal address, 03 --- illegal data value

The ASCII function codes supported by the CO Transmitter are shown below.

0x03 --- Read CO Status

Query

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x33	0x30	0x30	0x30	0x30
0x30	0x30	0x30	0x31	LRC MSB	LRC LSB	0x0D	0x0A	

Response

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x33	0x30	0x32	
0x30	0x30	0x30	0x30 (CO normal) 0x31 (CO abnormal)	LRC MSB	LRC LSB	0x0D	0x0A

0x03 --- Read CO PPM

Query

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x33	0x30	0x30	0x30	0x31
0x30	0x30	0x30	0x31	LRC MSB	LRC LSB	0x0D	0x0A	

Response

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x33	0x30	0x32	
Register value MSB (PPM)	Register value (PPM)	Register value (PPM)	Register value LSB (PPM)	LRC MSB	LRC LSB	0x0D	0x0A

0x03 --- Read Temperature °C / °F

Query

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x33	0x30	0x30	0x30	0x32
0x30	0x30	0x30	0x31	LRC MSB	LRC LSB	0x0D	0x0A	

Response

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x33	0x30	0x32	
Register value MSB (PPM)	Register value (PPM)	Register value (PPM)	Register value LSB (PPM)	LRC MSB	LRC LSB	0x0D	0x0A

0x03 --- Read Buzzer Status

Query

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x33	0x30	0x30	0x30	0x33
0x30	0x30	0x30	0x31	LRC MSB	LRC LSB	0x0D	0x0A	

Response

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x33	0x30	0x32	
0x30	0x30	0x30	0x30 (buzzer not activated) 0x31 (buzzer activated)	LRC MSB	LRC LSB	0x0D	0x0A

0x03 --- Read Relay 1 Status

Query

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x33	0x30	0x30	0x30	0x34
0x30	0x30	0x30	0x31	LRC MSB	LRC LSB	0x0D	0x0A	

Response

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x33	0x30	0x32	
0x30	0x30	0x30	0x30 (relay 1 not activated) 0x31 (relay 1 activated)	LRC MSB	LRC LSB	0x0D	0x0A

0x03 --- Read Relay 2 Status

Query

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x33	0x30	0x30	0x30	0x35
0x30	0x30	0x30	0x31	LRC MSB	LRC LSB	0x0D	0x0A	

Response

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x33	0x30	0x32	
0x30	0x30	0x30	0x30 (relay 2 not activated) 0x31 (relay 2 activated)	LRC MSB	LRC LSB	0x0D	0x0A

0x03 --- Read Test Mode Status

Query

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x33	0x30	0x30	0x30	0x36
0x30	0x30	0x30	0x31	LRC MSB	LRC LSB	0x0D	0x0A	

Response

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x33	0x30	0x32	
0x30	0x30	0x30	0x30 (test not activated) 0x31 (test activated)	LRC MSB	LRC LSB	0x0D	0x0A

0x03 --- Read Fault Mode Status

Query

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x33	0x30	0x30	0x30	0x37
0x30	0x30	0x30	0x31	LRC MSB	LRC LSB	0x0D	0x0A	

Response

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x33	0x30	0x32	
0x30	0x30	0x30	0x30 (fault not activated) 0x31 (fault activated)	LRC MSB	LRC LSB	0x0D	0x0A

0x06 --- Write single register (BUZZER_ENABLE)

Query

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x30	0x38
0x30	0x30	0x30	0x30 (buzzer disable) 0x31 (buzzer enable)	LRC MSB	LRC LSB	0x0D	0x0A	

Response

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x30	0x38
0x30	0x30	0x30	0x30 or 0x31	LRC MSB	LRC LSB	0x0D	0x0A	

0x06 --- Write single register (BUZZER_TRIP)

Query

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x30	0x39
0x30	0x30	Register value	Register value LSB	LRC MSB	LRC LSB	0x0D	0x0A	

Response

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x30	0x39
0x30	0x30	Register value	Register value LSB	LRC MSB	LRC LSB	0x0D	0x0A	

0x06 --- Write single register (BUZZER_DELAY)

Query

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x30	0x40
0x30	0x30	0x30	Register value LSB	LRC MSB	LRC LSB	0x0D	0x0A	

Response

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x30	0x40
0x30	0x30	0x30	Register value LSB	LRC MSB	LRC LSB	0x0D	0x0A	

0x06 --- Write single register (RELAY1_TRIP)

Query

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x30	0x41
0x30	0x30	Register value	Register value LSB	LRC MSB	LRC LSB	0x0D	0x0A	

Response

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x30	0x41
0x30	0x30	Register value	Register value LSB	LRC MSB	LRC LSB	0x0D	0x0A	

0x06 --- Write single register (RELAY1_HYST)

Query

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x30	0x42
0x30	0x30	Register value	Register value LSB	LRC MSB	LRC LSB	0x0D	0x0A	

Response

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x30	0x42
0x30	0x30	Register value	Register value LSB	LRC MSB	LRC LSB	0x0D	0x0A	

0x06 --- Write single register (RELAY1_DELAY)

Query

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x30	0x43
0x30	0x30	0x30	Register value LSB	LRC MSB	LRC LSB	0x0D	0x0A	

Response

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x30	0x43
0x30	0x30	0x30	Register value LSB	LRC MSB	LRC LSB	0x0D	0x0A	

0x06 --- Write single register (RELAY2_TRIP)

Query

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x30	0x44
0x30	0x30	Register value	Register value LSB	LRC MSB	LRC LSB	0x0D	0x0A	

Response

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x30	0x44
0x30	0x30	Register value	Register value LSB	LRC MSB	LRC LSB	0x0D	0x0A	

0x06 --- Write single register (RELAY2_HYST)

Query

0x3A	Slave address 0x01 to 0xFF MSB		Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x30	0x45
0x30	0x30	Register value		Register value LSB	LRC MSB		LRC LSB	0x0D	0x0A

Response

0x3A	Slave address 0x01 to 0xFF MSB		Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x30	0x45
0x30	0x30	Register value		Register value LSB	LRC MSB		LRC LSB	0x0D	0x0A

0x06 --- Write single register (RELAY2_DELAY)

Query

0x3A	Slave address 0x01 to 0xFF MSB		Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x31	0x30
0x30	0x30	0x30		Register value LSB	LRC MSB		LRC LSB	0x0D	0x0A

Response

0x3A	Slave address 0x01 to 0xFF MSB		Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x31	0x30
0x30	0x30	0x30		Register value LSB	LRC MSB		LRC LSB	0x0D	0x0A

0x06 --- Write single register (TEST_MODE_ENABLE)

Query

0x3A	Slave address 0x01 to 0xFF MSB		Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x31	0x31
0x30	0x30	0x30	0x30 (buzzer disable) 0x31 (buzzer enable)		LRC MSB		LRC LSB	0x0D	0x0A

Response

0x3A	Slave address 0x01 to 0xFF MSB		Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x31	0x31
0x30	0x30	0x30	0x30 or 0x31		LRC MSB		LRC LSB	0x0D	0x0A

0x06 --- Write single register (TEST_TIME)

Query

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x31	0x32
0x30	0x30	0x30	Register value LSB	LRC MSB	LRC LSB		0x0D	0x0A

Response

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x31	0x32
0x30	0x30	0x30	Register value LSB	LRC MSB	LRC LSB		0x0D	0x0A

0x06 --- Write single register (FAULT_MODE_ENABLE)

Query

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x31	0x33
0x30	0x30	0x30	0x30 (fault mode disable) 0x31 (fault mode enable) 0x32 (fault mode reset)	LRC MSB	LRC LSB		0x0D	0x0A

Response

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x31	0x33
0x30	0x30	0x30	0x30 or 0x31 or 0x32	LRC MSB	LRC LSB		0x0D	0x0A

0x06 --- Write single register (FAULT_TIME)

Query

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x31	0x34
0x30	0x30	0x30	Register value LSB	LRC MSB	LRC LSB		0x0D	0x0A

Response

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x31	0x34
0x30	0x30	0x30	Register value LSB	LRC MSB	LRC LSB		0x0D	0x0A

0x06 --- Write single register (DISPLAY_MODE)

Query

0x3A	Slave address 0x01 to 0xFF MSB		Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x31	0x35
0x30	0x30	0x30	0x30 (status display) 0x31 (CO value display)		LRC MSB	LRC LSB		0x0D	0x0A

Response

0x3A	Slave address 0x01 to 0xFF MSB		Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x31	0x35
0x30	0x30	0x30	0x30 or 0x31		LRC MSB	LRC LSB		0x0D	0x0A

0x06 --- Write single register (BACKLIGHT_ENABLE)

Query

0x3A	Slave address 0x01 to 0xFF MSB		Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x31	0x36
0x30	0x30	0x30	0x30 (backlight disable) 0x31 (backlight enable)		LRC MSB	LRC LSB		0x0D	0x0A

Response

0x3A	Slave address 0x01 to 0xFF MSB		Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x31	0x36
0x30	0x30	0x30	0x30 or 0x31		LRC MSB	LRC LSB		0x0D	0x0A

0x06 --- Write single register (OUTPUT_TEST)

Query

0x3A	Slave address 0x01 to 0xFF MSB		Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x31	0x37
0x30	0x30	0x30	0x30 to 0x36		LRC MSB	LRC LSB		0x0D	0x0A

Response

0x3A	Slave address 0x01 to 0xFF MSB		Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x31	0x37
0x30	0x30	0x30	0x30 to 0x36		LRC MSB	LRC LSB		0x0D	0x0A

0x06 --- Write single register (RECAL_MODE_ENABLE)

Query

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x31	0x38
0x30	0x30	0x30	0x30 (recal mode disable) 0x31 (recal mode enable) 0x32 (recal mode reset)	LRC MSB	LRC LSB		0x0D	0x0A

Response

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x31	0x38
0x30	0x30	0x30	0x30 or 0x31	LRC MSB	LRC LSB		0x0D	0x0A

0x06 --- Write single register (RECAL_TIME)

Query

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x31	0x39
0x30	0x30	0x30	Register value LSB	LRC MSB	LRC LSB		0x0D	0x0A

Response

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x31	0x39
0x30	0x30	0x30	Register value LSB	LRC MSB	LRC LSB		0x0D	0x0A

0x06 --- Write single register (C/F)

Query

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x31	0x40
0x30	0x30	0x30	Register value LSB	LRC MSB	LRC LSB		0x0D	0x0A

Response

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x31	0x40
0x30	0x30	0x30	Register value LSB	LRC MSB	LRC LSB		0x0D	0x0A

0x06 --- Write single register (TEMPERATURE_OFFSET)

Query

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x31	0x41
0x30	0x30	0x30	Register value LSB	LRC MSB	LRC LSB		0x0D	0x0A

Response

0x3A	Slave address 0x01 to 0xFF MSB	Slave address 0x01 to 0xFF LSB	0x30	0x36	0x30	0x30	0x31	0x41
0x30	0x30	0x30	Register value LSB	LRC MSB	LRC LSB		0x0D	0x0A

Exception response

0x3A	Slave address (0x01 to 0xFF) MSB	Slave address (0x01 to 0xFF) LSB	Function Code * + 0x80 MSB	Function Code * + 0x80 LSB		0x30
Exception code 0x01, 0x02 or 0x03 (0x31, 0x32 or 0x33)			LRC MSB	LRC LSB	Return-line feed (CRLF) 0x0D	Return-line feed (CRLF) 0x0A

* If Function Code = 03, then MSB = 0x38, LSB = 0x33, for example