1 RS-485 (Modbus/Mimic)

The factory default configuration is for the RS-485 as a Modbus Slave.

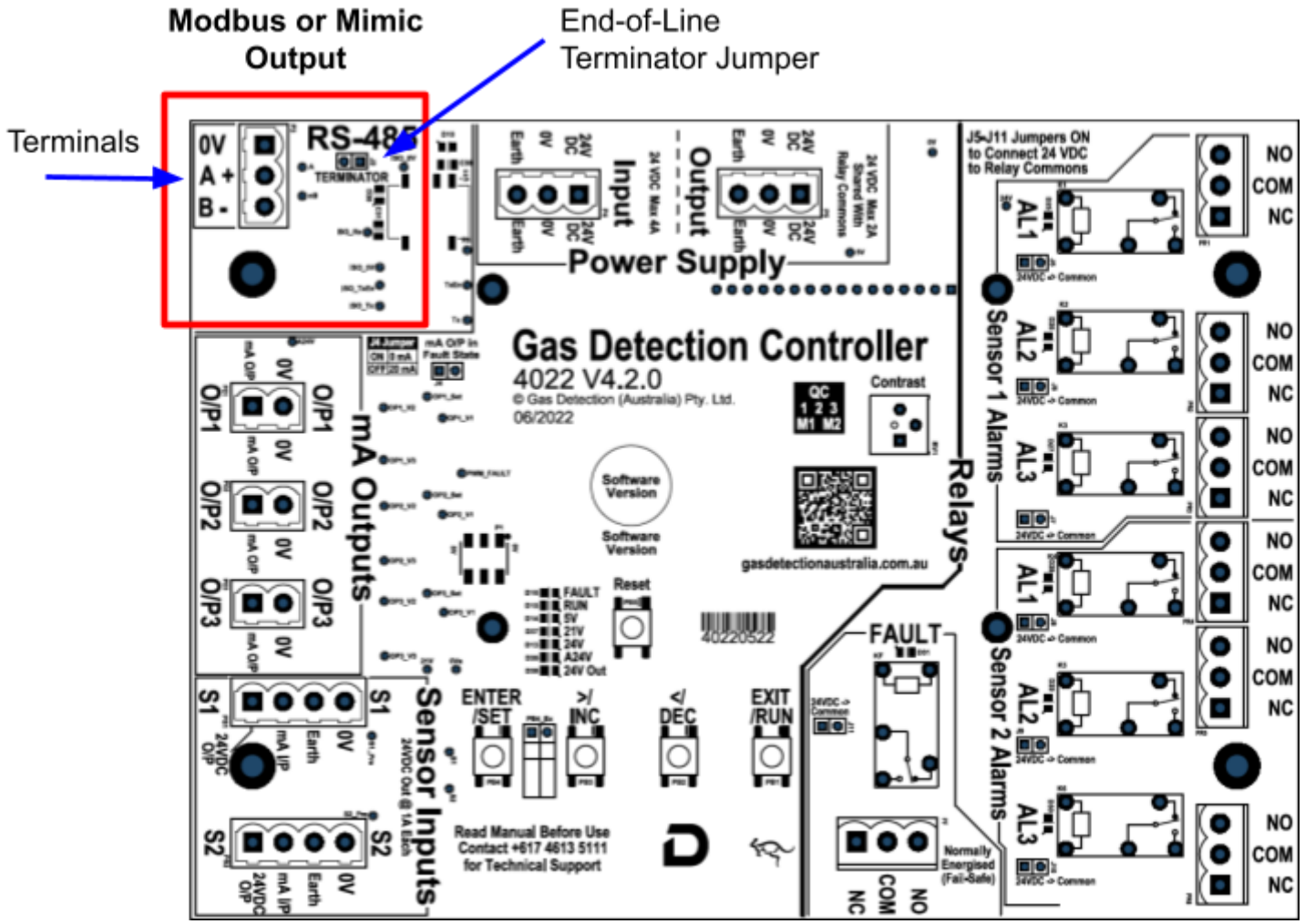

Figure 1: 4022 PCB outline showing RS-485 connection

1.1 Modbus Protocol

The 4022 implements an isolated RS-485 (TIA/EIA-485) MODBUS (V1.1b3) compliant **RTU** slave using 9600 baud (**bps**), 8 Data Bits, No parity and ONE STOP BIT (**RTU 9600-8N1**). All integers are signed unless stated. Modbus RTU requires 3.5 Character (>3.7 ms) spacing between packets. Normally the 4022 will respond within 20 ms of receiving the request from the Modbus master.

1.2 Modbus Registers

Table 1: Modbus Registers

Modbus Function Code	Physical Address (dec)	Offset (dec)	Legacy Address (dec)	Details
0x01 Coil Status	00100	00101	00101	**Sensor 1 Alarm 1:** Single Bit If Bit Value is 0 = Alarm is Off If Bit Value is 1 = Alarm is On
	00101	00102	00102	**Sensor 2 Alarm1:** Single Bit If Bit Value is 0 = Alarm is Off If Bit Value is 1 = Alarm is On
	00200	00201	00201	**Sensor 1 Alarm 2:** Single Bit If Bit Value is 0 = Alarm is Off If Bit Value is 1 = Alarm is On
	00201	00202	00202	**Sensor 2 Alarm 2:** Single Bit If Bit Value is 0 = Alarm is Off If Bit Value is 1 = Alarm is On
	00300	00301	00301	**Sensor 1 Alarm 3:** Single Bit If Bit Value is 0 = Alarm is Off If Bit Value is 1 = Alarm is On

Modbus Function Code	Physical Address (dec)	Offset (dec)	Legacy Address (dec)	Details
	00301	00302	00302	**Sensor 2 Alarm 3:** Single Bit If Bit Value is 0 = Alarm is Off If Bit Value is 1 = Alarm is On
	00400	00401	00401	**System Fault:** Single Bit If Bit Value is 0 = System not in Fault If Bit Value is 1 = System in Fault
0x03 (Holding Registers)	00100	00101	40101	**Sensor 1 Gas Type:** 16 Bit Integer (See)
	00101	00102	40102	**Sensor 2 Gas Type:** 16 Bit Integer (See)
	00200	00201	40201	**Sensor 1 Units of Concentration:** 16 Bit Integer Response: 0 = PPM 1 = % Vol. 2 = % LEL 3 = PPB

Modbus Function Code	Physical Address (dec)	Offset (dec)	Legacy Address (dec)	Details
	00201	00202	40202	**Sensor 2 Units of Concentration:** 16 Bit Integer Response: 0 = PPM 1 = % Vol. 2 = % LEL 3 = PPB
	00300	00301	40301	**Sensor 1 Enabled:** 16 Bit Integer Response: 0 = OFF 1 = ON
	00301	00302	40302	**Sensor 2 Enabled:** 16 Bit Integer Response: 0 = OFF 1 = ON
	00400	00401	40401	**System Equipment ID:** 16 Bit Integer Response: 4020
	00500	00501	40501	**Sensor 1 Range:** 16 Bit Integer Response: $5000 \geq 50000$ Range: $= Response \times 10^{Sensor\ 1\ Scale}$
	00501	00502	40502	**Sensor 2 Range:** 16 Bit Integer Response: $5000 \geq 50000$ Range: $= Response \times 10^{Sensor\ 2\ Scale}$

Modbus Function Code	Physical Address (dec)	Offset (dec)	Legacy Address (dec)	Details
	00600	00601	40601	**Sensor 1 Scale:** 16 Bit Integer Response: $-4 \geq 1$
	00601	00602	40602	**Sensor 2 Scale:** 16 Bit Integer Response: $-4 \geq 1$
	00700	00701	40701	**Sensor 1 Alarm 1 Threshold:** 16 Bit Integer Response: $5000 \geq 50000$ Threshold: $= Response \times 10^{Sensor\ 1\ Scale}$
	00701	00702	40702	**Sensor 2 Alarm 1 Threshold:** 16 Bit Integer Response: $0 \geq 50000$ Threshold: $= Response \times 10^{Sensor\ 2\ Scale}$
	00800	00801	40801	**Sensor 1 Alarm 2 Threshold:** 16 Bit Integer Response: $0 \geq 50000$ Threshold: $= Response \times 10^{Sensor\ 1\ Scale}$
	00801	00802	40802	**Sensor 2 Alarm 2 Threshold:** 16 Bit Integer Response: $0 \geq 50000$ Threshold: $= Response \times 10^{Sensor\ 2\ Scale}$

Modbus Function Code	Physical Address (dec)	Offset (dec)	Legacy Address (dec)	Details
	00900	00901	40901	**Sensor 1 Alarm 3 Threshold:** 16 Bit Integer Response: $0 \geq 50000$ Threshold: $= Response \times 10^{Sensor\ 1\ Scale}$
	00901	00902	40902	**Sensor 2 Alarm 3 Threshold:** 16 Bit Integer Response: $0 \geq 50000$ Threshold: $= Response \times 10^{Sensor\ 2\ Scale}$
	01000	01001	41001	**Sensor 1 Hysteresis:** 16 Bit Integer Response: $25 \geq 10000$ Hysteresis: $= Response \times 10^{Sensor\ 1\ Scale}$
	01001	01002	41002	**Sensor 2 Hysteresis:** 16 Bit Integer Response: $25 \geq 10000$ Hysteresis: $= Response \times 10^{Sensor\ 2\ Scale}$
	01100	01101	41101	**Sensor 1 Alarm Threshold Direction (Sign):** 16 Bit Integer Response: 0 = Rising 1 = Falling 2 = Range (AL1 Rising, AL2 Falling & AL3 unused)

Modbus Function Code	Physical Address (dec)	Offset (dec)	Legacy Address (dec)	Details
	01101	01102	41102	**Sensor 2 Alarm Threshold Direction (Sign):** 16 Bit Integer Response: 0 = Rising 1 = Falling 2 = Range (AL1 Rising, AL2 Falling & AL3 unused)
	01200	01201	41201	**Sensor 1 Latching Alarms:** 16 Bit Integer Response: 0 = Non Latching Alarms 1 = Latching Alarms
	01201	01202	41202	**Sensor 2 Latching Alarms:** 16 Bit Integer Response: 0 = Non Latching Alarms 1 = Latching Alarms
	01300	01301	41301	**Sensor 1 Alarm Validation Delay:** 16 Bit Integer Response: $0 \geq 999$ seconds
	01301	01302	41302	**Sensor 2 Alarm Validation Delay:** 16 Bit Integer Response: $0 \geq 999$ seconds
	01400	01401	41401	**Sensor 1 Alarm Run On Time:** 16 Bit Integer Response: $0 \geq 3600$ seconds

Modbus Function Code	Physical Address (dec)	Offset (dec)	Legacy Address (dec)	Details
	01401	01402	41402	**Sensor 2 Alarm Run On Time:** 16 Bit Integer Response: $0 \geq 3600$ seconds
	01500	01501	41501	**Sensor 1 Value/Status:** 16 Bit Integer Response: $[0, 1]$ 0 = Always show sensor value on screen, 1 = Show “OK” when sensor value is within 80 % of the first alarm level
	01501	01502	41502	**Sensor 2 Value/Status:** 16 Bit Integer Response: $[0, 1]$ 0 = Always show sensor value on screen, 1 = Show “OK” when sensor value is within 80 % of the first alarm level
	01600 - 01615	01601 - 01616	41601 - 41616	**Sensor 1 Location Name:** String 16x Char long
	01700 - 01715	01701 - 01716	41701 - 41716	**Sensor 2 Location Name:** String 16x Char long

Modbus Function Code	Physical Address (dec)	Offset (dec)	Legacy Address (dec)	Details
	02000	02001	42001	**mA Output 1 Current/Voltage (Range):** 16 Bit Integer Response: [0 , 1] 0 = 4-20 mA Output, 1 = 0-20 mA Output.
	02001	02002	42002	**mA Output 2 Current/Voltage (Range):** 16 Bit Integer Response: [0 , 1] 0 = 4-20 mA Output, 1 = 0-20 mA Output.
	02002	02003	42003	**mA Output 3 Current/Voltage (Range):** 16 Bit Integer Response: [0 , 1] 0 = 4-20 mA Output, 1 = 0-20 mA Output.

Modbus Function Code	Physical Address (dec)	Offset (dec)	Legacy Address (dec)	Details
	02100	02101	42101	**mA Output 1 Mode:** 16 Bit Integer Response: $[0 - 8]$ 0 = Off, 1 = Sensor 1 Mirror (O/P = I/P), 2 = Maximum of Sensor 1 & 2, 3 = Minimum of Sensor 1 & 2, 4 = Average of Sensor 1 & 2, 5 = Scaled Sensor 1, 6 = Scaled Sensor 2, 7 = Scaled Maximum of Sensor 1 & 2, Scaled Minimum of Sensor 1 & 2.
	02101	02102	42102	**mA Output 2 Mode:** 16 Bit Integer Response: $[0 - 8]$ 0 = Off, 1 = Sensor 1 Mirror (O/P = I/P), 2 = Maximum of Sensor 1 & 2, 3 = Minimum of Sensor 1 & 2, 4 = Average of Sensor 1 & 2, 5 = Scaled Sensor 1, 6 = Scaled Sensor 2, 7 = Scaled Maximum of Sensor 1 & 2, Scaled Minimum of Sensor 1 & 2.

Modbus Function Code	Physical Address (dec)	Offset (dec)	Legacy Address (dec)	Details
	02102	02103	42103	**mA Output 3 Mode:** 16 Bit Integer Response: $[0 - 8]$ 0 = Off, 1 = Sensor 1 Mirror (O/P = I/P), 2 = Maximum of Sensor 1 & 2, 3 = Minimum of Sensor 1 & 2, 4 = Average of Sensor 1 & 2, 5 = Scaled Sensor 1, 6 = Scaled Sensor 2, 7 = Scaled Maximum of Sensor 1 & 2, Scaled Minimum of Sensor 1 & 2.
	02200	02201	42201	**mA Output 1 Low Point Scaling:** 16 Bit Integer Response: $0 \geq 50000$ Point: $= Response \times 10^{Sensor\ 1\ Scale}$
	02201	02202	42202	**mA Output 2 Low Point Scaling:** 16 Bit Integer Response: $0 \geq 50000$ Point: $= Response \times 10^{Sensor\ 2\ Scale}$
	02202	02203	42203	**mA Output 3 Low Point Scaling:** 16 Bit Integer Response: $0 \geq 50000$ Point: $= Response \times 10^{Sensor\ 3\ Scale}$

Modbus Function Code	Physical Address (dec)	Offset (dec)	Legacy Address (dec)	Details
	02300	02301	42301	**mA Output 1 High Point Scaling:** 16 Bit Integer Response: $0 \geq 50000$ Point: $= Response \times 10^{Sensor\ 1\ Scale}$
	02301	02302	42302	**mA Output 2 Low Point Scaling:** 16 Bit Integer Response: $0 \geq 50000$ Point: $= Response \times 10^{Sensor\ 2\ Scale}$
	02302	02303	42303	**mA Output 3 Low Point Scaling:** 16 Bit Integer Response: $0 \geq 50000$ Point: $= Response \times 10^{Sensor\ 3\ Scale}$
	02400	02401	42401	**mA Output 1 Update Period:** 16 Bit Integer Response: $0 \geq 999$ seconds
	02401	02402	42402	**mA Output 2 Update Period:** 16 Bit Integer Response: $0 \geq 999$ seconds
	02402	02403	42403	**mA Output 3 Update Period:** 16 Bit Integer Response: $0 \geq 999$ seconds

Modbus Function Code	Physical Address (dec)	Offset (dec)	Legacy Address (dec)	Details
0x04 (Input Registers)	00000	00001	30001	Sensor 1 Concentration: 16 Bit Integer If Gas Range Is % LEL or % Vol. The Reading Value Is x 10
	00001	00002	30002	Sensor 2 Concentration: 16 Bit Integer If Gas Range Is % LEL or % Vol. The Reading Value Is x 10

1.4 Gas Type

16 Bit Integer	Gas Type	16 Bit Integer	Gas Type
0	CO	10	NH3
1	O2	11	NO2
2	CO2	12	Gas
3	FLM	13	R22
4	H2	14	R123

5	CH4	15	R134a
6	LNG	16	R407c
7	Prop	17	R410a
8	LPG	18	Refrg
9	H2S	19	" " (*Blank*)

Electrical Requirements:

Termination Resistors are required at both ends of the Bus if the line is longer than 30 m or if it is being used in a noisy environment. These should match the impedance of the cable used. For RS-485 Shielded Twisted Pair, this is typically 100 - 120Ω line impedance (Z_0). Ring or Star Topographies are NOT recommended for RS 485 Communications. If there is transmission trouble try to enable the bias resistors at your RS-485 master.