# INTECH Micro
# 2100-AO REV 1.1.


# Installation Guide.

## *Section A. Description, Ordering and Specifications.*
## *2100-AO Installation Guide Index.*

# INTECH Micro
# 2100-AO Rev 1.1

**8 Analogue Inputs,**
**12 Digital Inputs.**
**8 Analogue Outputs,**
**2 Relay Outputs.**

Z985


### *Features.*

- **Cost Effective PLC Analogue Output Expansion.**
  - **8 AO Require Only 7 PLC Digital Outputs.**
  - **Each Additional 2100-AO Used Requires Only 1 Extra PLC Digital Output.**
  - **4, 8, or 12 bit AO Resolution Selectable.**
  - **BCD or Clock/Reset AO Channel Selectable.**
- **8 Analogue Outputs: mA or V.**
- **8 Analogue Inputs: mA or V.**
- **8 PID on Board Controllers - Future Development.**
- **12 Bit Resolution.**
- **12 Digitally Isolated, Optocoupler Inputs.**
  - **4 Digital Inputs**
    - **State or Count.**
    - **Speeds up to 50Hz.**
- **2 Digital, Mains Isolated, Relay Outputs.**
- **1 AI can be Demultiplexed to 8 AO.**
- **8 AI can be Multiplexed to 1 AO.**
- **RS422/RS485 Up to 1200m.**
- **RS232 Cost Effective Radio Installation.**
- **RS232 Cost Effective PC or PLC AI or AO Expansion.**
- **Selectable Baud Rates.**
- **Easy Programming Via Microscan Maps.**
- **Programmable Station Number.**
- **Programmable Relay States - NO or NC.**
- **Comms Failure Time-out Using Relay 2.**
- **Comms TXE and TX Delay Programming.**
- **Programming Information Retained on Power Down.**
- **Universal AC/DC Power Supply.**
- **Easy to Install.**
- **Compact DIN Rail Mount Enclosure**

**2100 models include:**
**2100-4S : RS422 to RS485 Converter.**
**2100-A16 :16AI, 4DI, 2 Relay Out, 2 AO.**
**2100-A4 :4AI, 4DI, 4 Relay Out, 2 AO.**
**2100-A4e :4AI, 4DI, 8 Relay Out, 2 AO.**
**2100-AO :8 AO, 8 AI, 12 DI, 2 Relay Out.**
**2100-D :12DI, 12 Relay Out.**
**2100-IS :Isolated RS232 to RS422/485.**
**2100-M :16AI Multiplexer.**
**2100-ME :Memory Expansion for 2100-A.**
**2100-NET :Isolated Ethernet to RS232/422/485.**
**2100-NS :Non-Isolated RS232 to RS422/485.**
**2100-R :16 Relay Expansion for 2100-A.**
**2100-RL2 :2 Relay Expansion for 21 00-A.**

### *Ordering Information.*

**2100-AO-X** Standard Unit: All Analogue Inputs and Outputs 4~20mA, RS485 Comms, 85~264Vac/dc Power Supply.

**2100-AO** – □ – □ – □ – □

AO AI C PS

| Ranging Options for 2100-AO | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Analogue Output AO | | | | Analogue Input AI | | | | COMMS | C | Power Supply(4) | PS |
| mA | | V | | mA | | V | | RS232(1) | 232 | 85~264Vac/dc | H |
| 0~20mA | A | 0~10V | C | 0~20mA | A | 0~10V | C | RS422 | 422 | 23~90Vdc | M |
| 4~20mA | B | 2~10V | D | 4~20mA | B | 2~10V | D | RS485 | 485 | 10~28Vac/dc | L |

Note 1. The RS232 Comms. version comes complete with a RS232 kit, required for connecting the 2100-AO to a PC, etc. The kit contains: 1 x 5m RS232 cable; (2,10 & 15m available.) 1 x 9pin D type (25pin D type available).
Note 2. The 2100-AO is factory set to RS232 or RS422/485. The 2100-AO-X is field selectable for RS422 or RS485, and H or M power supply.
Note 3. The Analogue Output and Analogue Input ranges are factory set. They cannot be reconfigured in the field.
Note 4. Power supply 'H' is field selectable for 'M', and 'M' for 'H'. Power supply 'L' must be ordered separately.

### *Ordering Examples.*

1/ 2100-AO-N-A-B-232-L 2100-AO; 0~20mA Out; 4~20mA In; RS232 Comms; 10~28Vac/dc Power Supply.
2/ 2100-AO-N-D-C-485-H 2100-AO; 2~10V Out; 0~10V In; RS485 Comms; 85~264Vac/dc Power Supply.

### *Quality Assurance Programme.*

The modern technology and strict procedures of the ISO9001 Quality Assurance Programme applied during design, development, production and final inspection grant long term reliability of the instrument. This instrument has been designed and built to comply with EMC and Safety Standards requirements.

## *2100-AO Output Specifications.*

The eight analogue output ranges are factory set. They cannot be reconfigured in the field.

| | | | |
|---|---|---|---|
| Output Resolution | | 8 Outputs, 12bits, 4000 Steps Typical. (Some ranges may differ.) | |
| Output Type | | All Inputs are single ended. (ie all '-' commoned.) | |
| **V Outputs:** | | | |
| | -Ranges | 0~10V, 2~10V. | |
| | -Output Drive | 4mA Maximum. (2.5kΩ @ 10V) | |
| **mA Outputs:** | | | |
| | -Ranges | 0~20mA, 4~20mA. | |
| | -Output Drive | 12V Maximum. (600Ω @ 20mA) | |
| **Digital Outputs:** | | 2 Individually Isolated Changeover Relays with LED Indication of Each Output. | |
| | -Functions | The on Board Controllers (16 additional relays with 2100-R), Can be used as Set Point (SV), Switching Differential, Auto/Manual, Manual Output Setting, Dual Action Control, Single Action Control, Heat / Cool, Heat Only, Cool Only. | |
| | -Contact Material | Silver Alloy | |
| | -Relay Ratings | Maximum Rating | Approved to Standard |
| | | 250Vac, 2A | UL |
| | | 125Vac, 2A | CSA |
| | | 110Vdc, 0.3A; | |
| | | 30Vdc, 2A; | |
| | | 250Vac,1/6hp; | |
| | | 125Vac, 1/10hp. | |
| | -Number of Operations | 2 x $10^5$ Min, at 1A, 250Vac Resistive Load. | |

## *2100-AO Input Specifications.*

The eight analogue input ranges are factory set. They cannot be reconfigured in the field..

| | | | |
|---|---|---|---|
| Input Resolution | | 12 Bits, 4,000 Steps Typical. (Some ranges may differ.) | |
| Input Type | | All Inputs are single ended. (ie all '-' commoned.) | |
| **V Inputs** | | | |
| | - Input Impedance | >200kΩ. | |
| | - Maximum Over-range | 30Vdc Continuous. | |
| | - V Ranges | 0~10V, 2~10V. | |
| **mA Inputs** | | | |
| | - Input Resistance | 120Ω. | |
| | - Maximum Over-range | 30mAdc Continuous. | |
| | - mA Ranges | 0~20mA, 4~20mA. | |
| **Digital Inputs:** | | 12 Opto Isolated Inputs with LED Indication of Each Input. | |
| | -Functions | ON / OFF. | |
| | | DI 9, DI 10, DI 11 & DI 12 Only: Count, and Flow Metering. 50Hz Maximum. Count to 16383 & Rolls Over. Over Flow Detection. | |
| | -Input Voltage | 5~30Vdc. | |
| | -Threshold | 4.6V Typical. | |
| | -Load @ 5V | 1.1mA per Channel. | |
| | @ 12Vdc | 4.2mA per Channel. | |
| | @ 24Vdc | 9.6mA per Channel. | |

## *2100-AO General Specifications.*

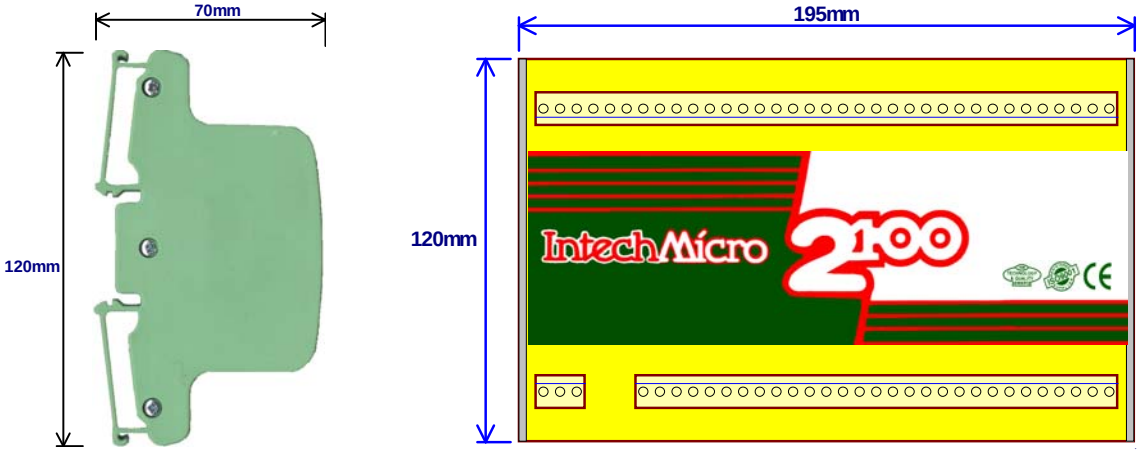
| | | | |
|---|---|---|---|
| **Comms:** | -Protocols | RS422/RS485 or RS232 | |
| | -Baud Rate | Selectable 2400, 4800, 9600. (Default = 9600). | |
| | -Format | 8 bit, No Parity, 1 Stop. | |
| | | | |
| **Power:** | -H | 85~264Vac/dc; 50/60Hz; 10VA. | |
| | -M | 23~90Vdc; 10VA. | |
| | -L | 10~28Vac/Vdc; 50/60Hz; 10VA. | |
| | | Refer '*2100-AO H1 Power Supply Settings'* for voltage selection instructions. | |
| Transmitter Power Supply | | 20Vdc±5%; Max. Load=100mA; Ripple<20mVrms; Common to Analog Inputs. | |
| | | | |
| **Safety and EMC Compliances:** | | | |
| EMC Compliances | | Emissions EN 55022-A. Immunity EN 50082-1. | |
| Safety Compliance | | EN 60950. | |
| Mains Isolation | | 250Vac. | |
| Mains Isolation Test Voltage | | -To all Inputs and Outputs: | 3000Vac 50Hz for 1min |
| | | -To Earth | 1500Vac 50Hz for 1 min. |
| Input/Output Isolation Test Voltages | | -Digital Input to Analogue Input/Output: | 1000Vdc for 1min. |
| | | -Comms to Analogue Input/Output: | 1000Vdc for 1min. |
| | | -Comms to Digital Input: | 1000Vdc for 1min. |
| | | -Relay Outputs to All Other Terminals: | 3000Vac 50Hz for 1min. |
| | | -Between Relay Outputs: | 1500Vac 50Hz for 1min. |
| | | | |
| **General Specifications:** (Unless otherwise stated in other input specifications.) | | | |
| Accurate to | | <±0.1% FSO Typical. (Unless otherwise stated in input specifications.) | |
| Linearity & Repeatability | | <±0.1% FSO Typical. | |
| Channel Separation | | <±0.1% FSO Typical. | |
| Ambient Drift | | <±0.01%/C FSO Typical. | |
| RF Immunity | | <±1% Effect FSO Typical. | |
| Permanent Memory ($E^2$ROM) | | 10,000 Writes per Input Parameter. | |
| | | 10 Year Data Retention. | |
| Operating Temperature | | 0~60C. | |
| Storage Temperature | | -20~80C. | |
| Operating Humidity | | 5~85%RH Max. Non-Condensing. | |
| Housing | -Material | ABS Inflammability V0 (UL94) | |
| | -Dimensions | L=195, W=120, H=70mm. | |
| | -Mounting | 35mm Symmetrical Mounting Rail. | |
| | -Weight | 900g. Includes Packaging. | |

Note 1. Contact INTECH INSTRUMENTS for more detailed programming information.

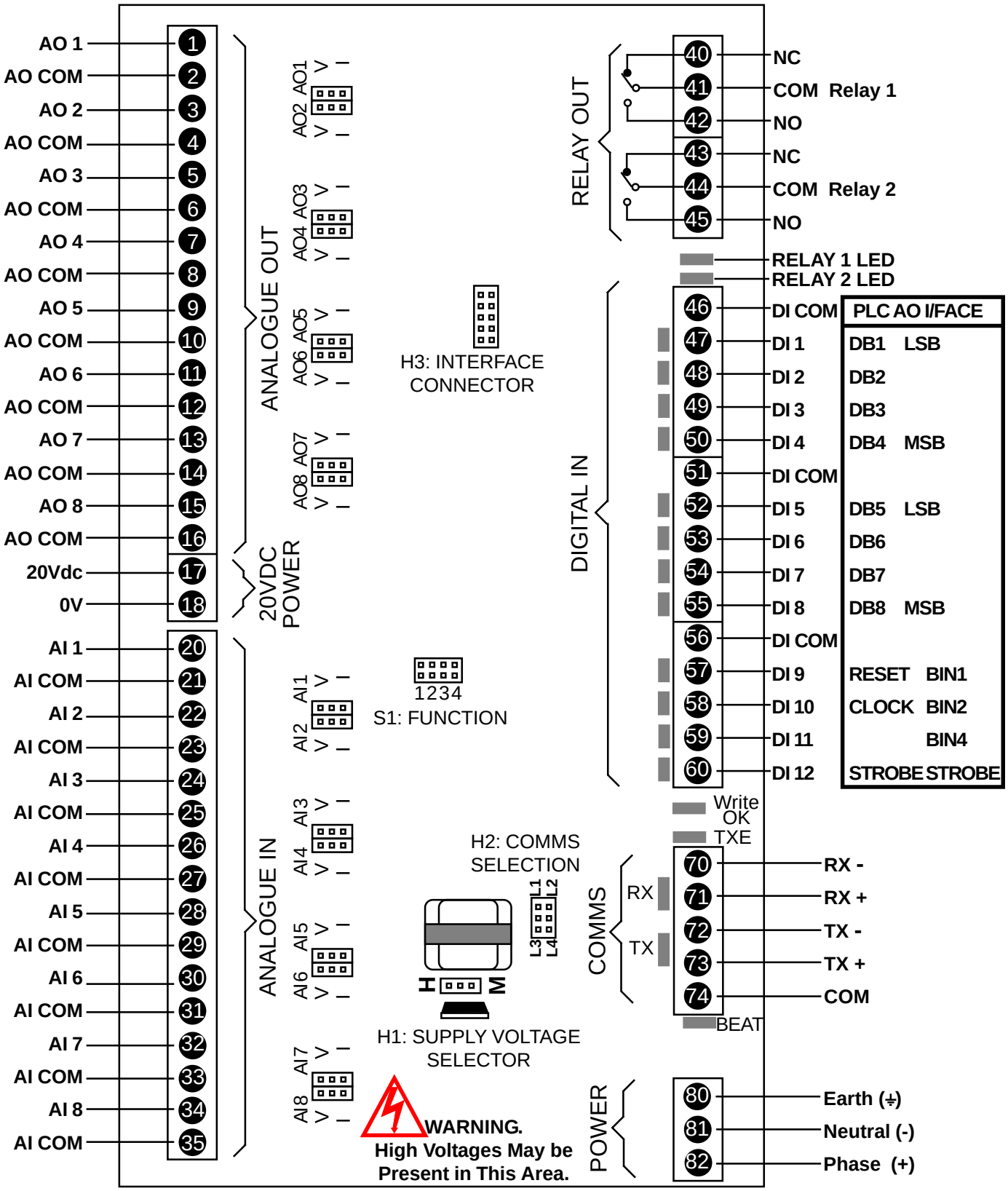
**Product Liability.** This information describes our products. It does not constitute guaranteed properties and is not intended to affirm the suitability of a product for a particular application. Due to ongoing research and development, designs, specifications, and documentation are subject to change without notification. Regrettably, omissions and exceptions cannot be completely ruled out. No liability will be accepted for errors, omissions or amendments to this specification. Technical data are always specified by their average values and are based on Standard Calibration Units at 25C, unless otherwise specified. Each product is subject to the 'Conditions of Sale'.
**Warning: These products are not designed for use in, and should not be used for patient connected applications. In any critical installation an independant fail-safe back-up system must always be implemented.**

**CAUTION: Dangerous voltages may be present. The 2100-AO has no user serviceable parts.**
**Protective enclosure only to be opened by qualified personnel.**
**Remove ALL power sources before removing protective cover.**

## *2100-AO Rev 1.1 Dimensions.*



## *2100-AO Terminals and Layout.*




**Only adjust jumpers with power OFF.**

## *Section B. Jumpers and LED Functions Tables.*
## *2100-AO Jumpers and LED Functions Tables.*

**CAUTION: Dangerous voltages may be present. The 2100-AO has no user serviceable parts.**
**Protective enclosure only to be opened by qualified personnel.**
**Remove ALL power sources before removing protective cover.**

*** For ALL programming tables.** Jumper Status: **0=JUMPER NOT INSERTED 1=JUMPER INSERTED.**
* Refer to *'2100-AO Terminals and Layout'* for the location of the following jumpers.

### *2100-AO S1 Function Settings*.

| Function Jumper Settings | | | | |
|---|---|---|---|---|
| **Function** | **S1-1** | **S1-2** | **S1-3** | **S1-4** |
| 9600baud note1 | 0 | 0 | 0 | 0 |
| 4800baud | 0 | 1 | 0 | 0 |
| 2400baud | 1 | 1 | 0 | 0 |
| Test Mode note2 | 0 | 0 | 1 | 0 |

Note 1. Factory Default.
Note 2. Factory use ONLY.

### *2100-AO H1 Power Supply Settings.*

| Power Supply Jumper Settings | |
|---|---|
| **H1** | **Power Supply Voltage Range** |
| H | Jumper for 85~264Vac/dc |
| M | Jumper for 23~90Vdc |

Note 1. Power must be OFF before changing H1's position.
Note 2. Exceeding these parameters may damage the unit.
Note 3. Ensure the enclosure label is correctly labelled for the jumper position.
Note 4. Low Voltage Power Supply version is fixed, and has no jumper. This must be ordered separately.

### *2100-AO H2 Comms Settings.*

| COMMS Jumper Settings | | | | |
|---|---|---|---|---|
| **Protocol** | **L1** | **L2** | **L3** | **L4** |
| RS232 STD | 0 | 0 | 1 | 0 |
| RS232 RADIO | 1 | 0 | 0 | 0 |
| RS422 | 1 | 1 | 0 | 0 |
| RS485 | 0 | 0 | 1 | 1 |

***Linking for RS422***


***Linking for RS485***


Note 1. RS232 must be ordered separately to RS422/485.
Note 2. RS422 can be jumpered for RS485, and vice versa.

### *2100-AO LED Descriptions.*

| LED Descriptions | |
|---|---|
| **LED Name** | **LED Function** |
| RX | Active when Station is receiving serial data. |
| TX | Active only when Station is transmitting serial data. |
| TXE | Active only when Station is ready to transmit data. |
| BEAT | Heart beat. Continual flashing indicates Station healthy |
| WRITE OK | Active when a write command has been actioned. |
| Digital Output | Indicates when their respective output relay is energized. |
| Digital Input | Indicates when their respective input is energized, or counting. |

### *2100-AO Analogue Input Programming.*

| AI1, AI2, AI3, AI4, AI5, AI6, AI7 & AI8 Analogue Input Programming | | |
|---|---|---|
| **Input Type** | **I** | **V** |
| Volts (0~10V & 2~10V) | 0 | 1 |
| millAmps (0~20mA & 4~20mA) | 1 | 0 |

Note 1. The eight analogue input ranges are factory set. They cannot be reconfigured in the field.
Note 2. Each output can be programmed to a different range.
Note 3.. Input ranges also need to be selected in software.

### *2100-AO Analogue Output Programming.*

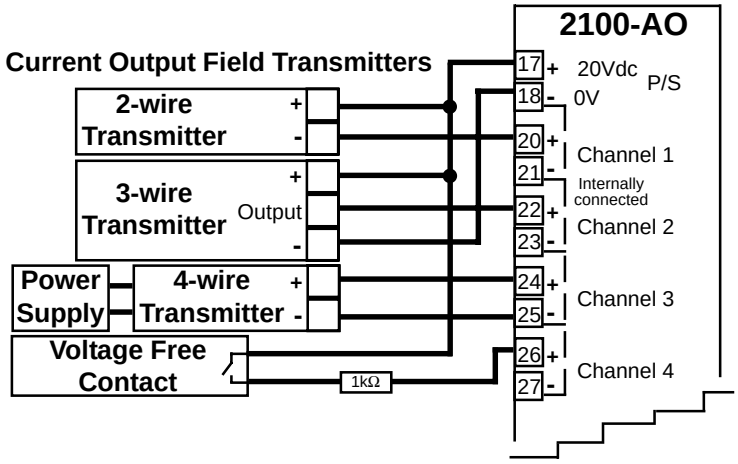
| AO1, AO2, AO3, AO4, AO5, AO6, AO7 & AO8 Analogue Output Programming | | |
|---|---|---|
| **Input Type** | **I** | **V** |
| Volts (0~10V & 2~10V) | 0 | 1 |
| millAmps (0~20mA & 4~20mA) | 1 | 0 |

Note 1. The eight analogue output ranges are factory set. They cannot be reconfigured in the field.
Note 2. Each output can be programmed to a different range.
Note 3. Output ranges also need to be selected in software.

## *Section C. Input and Output Connection Examples.*

### *2100-AO Input Connection Diagram for mA Inputs.*

Connection configuration for 2 wire, 3 wire and 4 wire transmitters, and digital inputs.




Note 1. Maximum load on 20V P/S = 100mA.

Note 2. All inputs need to be programmed. Refer to Analogue Input Programming.

Note 3. Inputs can be used as digital inputs, for sensing voltage free field contacts.

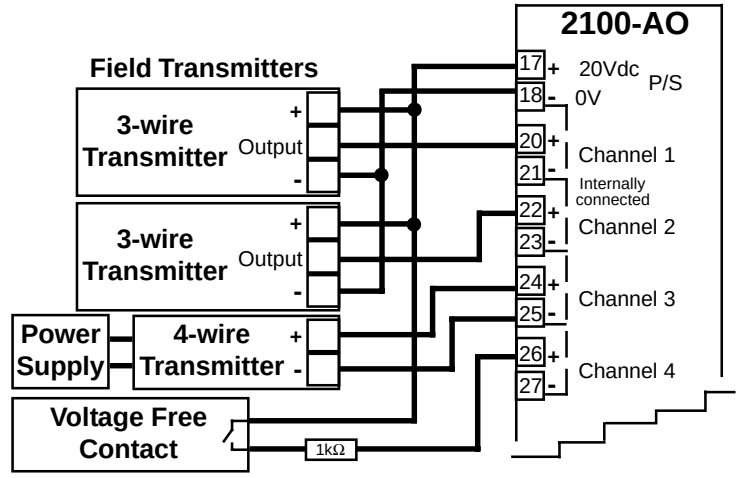
Note 4. All cables must be screened, and the screens earthed at one end only.

Note 5. All 2100-AO inputs are single ended. (ie, all negative inputs are internally connected.

Note 6. Voltage free contact values must be brought in through 'tags' in the Scada Software.

### *2100-AO Input Connection Diagram for Voltage Inputs.*

Connection configuration for 3 wire and 4 wire transmitters, and digital inputs.




Note 1. Maximum load on 20V P/S = 100mA.

Note 2. All inputs need to be programmed. Refer to Analogue Input Programming.

Note 3. Inputs can be used as digital inputs, for sensing voltage free field contacts.

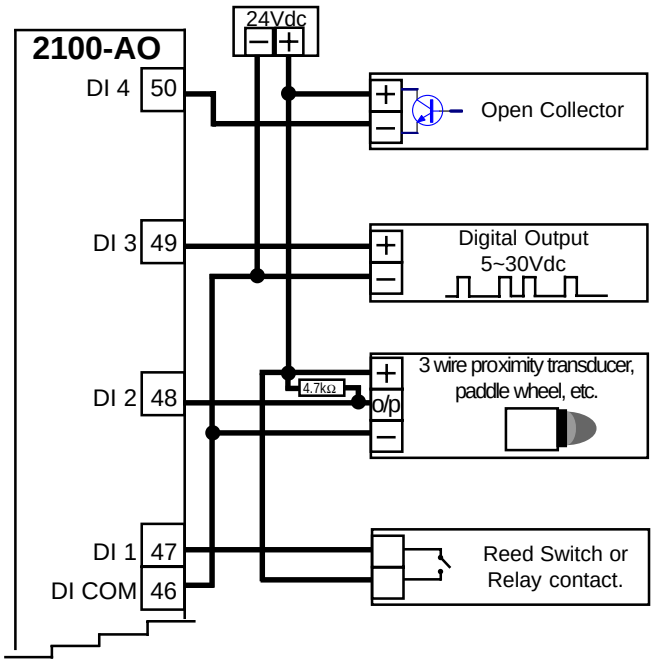
Note 4. All cables must be screened, and the screens earthed at one end only.

Note 5. Input voltages must not exceed 30V.

Note 6. All 2100-AO inputs are single ended. (ie, all negative inputs are internally connected.

Note 7. Voltage free contact values must be brought in through 'tags' in the Scada Software.

## *2100-AO Connection Example Diagram for Digital Inputs.*




Note 1. Inputs can be:
State - i.e. ON or OFF.
Count - 0~50Hz (DI 9~DI 12 Only)

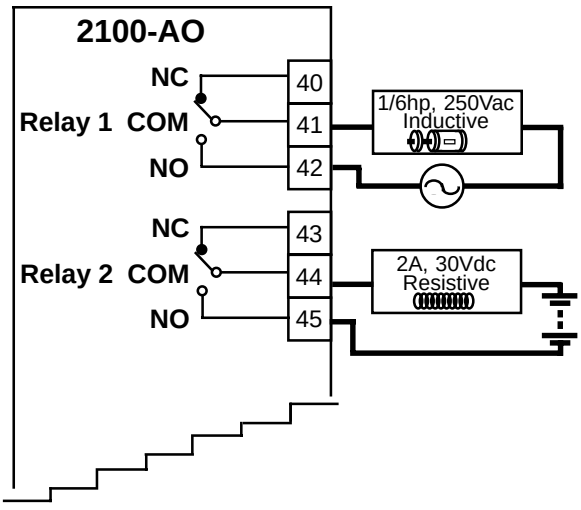
Note 2. LED indication per input. LED intensity depends on voltage level at the input terminals. Refer to '*Specifications*' for input loads.

Note 3. For scaling of counter inputs, totalising and flow data conversion, refer to Microscan Configuration Manual, line setup/counter scaling.

Note 4. All cables must be screened, with screen earthed at one end only. Refer 'The Proper Installation & Wiring of the 2100-AO.'

Note 5. Do not fit the 4K7 resistor for 3 wire PNP transducers.

## *2100-AO Connection Example Diagram for Digital Outputs.*




Note 1. With relays NOT energized, and 'Normally Off' state selected (refer Note 3)
NO = Normally Open.
COM = Common.
NC = Normally Closed.
Heating Relay: NO, closes when heating required.
Cooling Relay: NO, closes when cooling required.

Note 2. Both relays are change-over.

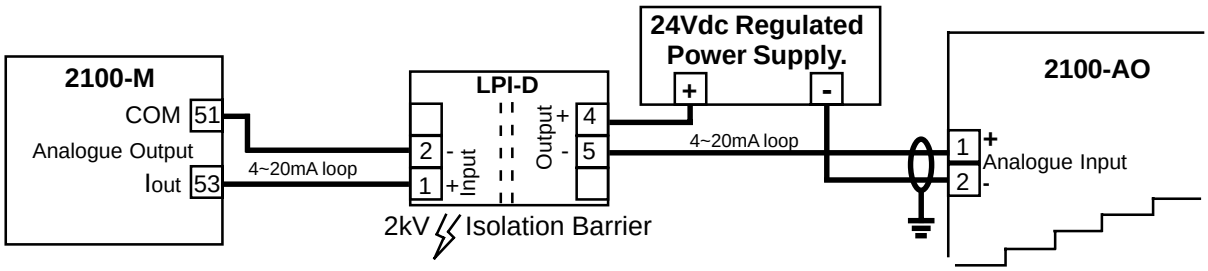
Note 3. The relays can be configured for a 'Normally ON' or 'Normally OFF' output state. (E.g. for fail safe operation.) The 'Normally ON/OFF' settings are retained in software on power down, but the relays are de-energized. The 'Normally ON/OFF' state of the relay can be changed in the Advanced dialog box for the onboard relays, or using the Relay States dialog box for the 2100-R. Refer to MicroScan Configuration Manual.

Note 4. Relay 2 can be selected as a Comms failure time-out alarm. The relay is normally active and deactivates after 5mins if no Comms messages are received. This function does not detect microprocessor failure. When used for this function the relay cannot be used for any other function.

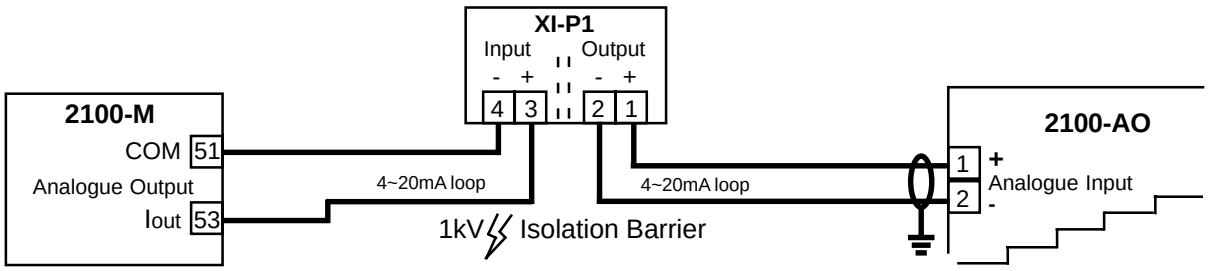
Note 5. LED indication on each output when each relay is energized.

Note 6. Single Action Setting is a global setting for the station.

### *2100-AO Connection Diagram Using an LPI-D Current Loop Isolator on the Input.*




### *2100-AO Connection Diagram Using an XI-P1 Current Loop Isolator on the Input.*

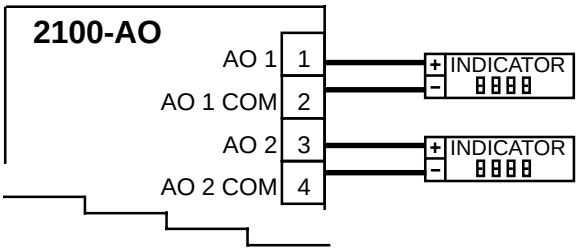



### *Section D. Connecting to a Microscan Scada System.*
### *2100-AO Analogue Outputs Controlled by Scada.*

AO 1 to 8 are controlled by the Scada Software.
12 bit output nominally = 0~4095 for 4~20mA (or 0~10V etc.) out:

0bit = 4mA (0V);
2048 = 12mA (5V);
4095 = 20mA (10V).

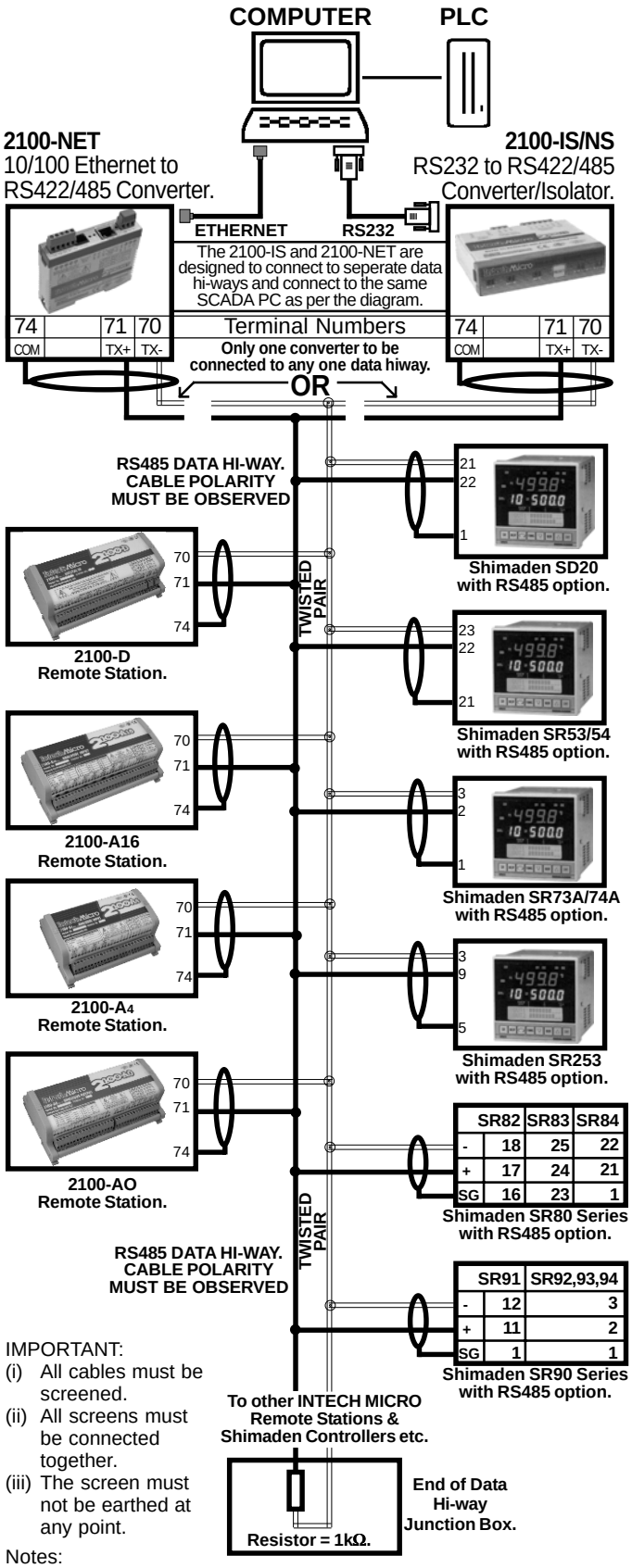
For 4~20mA output, Loop Powered Indicators can be used. 12V maximum at 20mA (600Ω at 20mA)




**CAUTION: Dangerous voltages may be present. The 2100-AO has no user serviceable parts.**
**Protective enclosure only to be opened by qualified personnel.**
**Remove ALL power sources before removing protective cover.**

**DO NOT GUESS TX OR RX CONNECTIONS. FOLLOW THE TERMINAL NUMBERS IN THE SERIAL CONNECTION DIAGRAMS EXACTLY.**

## *OUTSTATION LAYOUT. 2-Wire RS485 Serial Connections.*



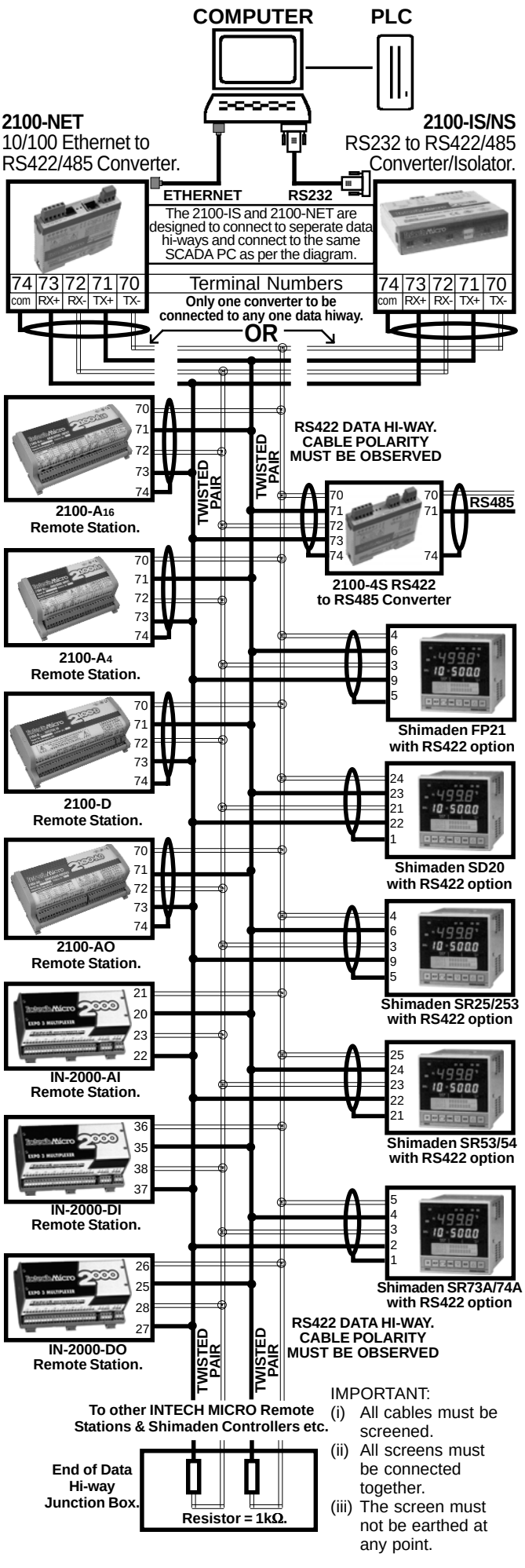

IMPORTANT:
(i) All cables must be screened.
(ii) All screens must be connected together.
(iii) The screen must not be earthed at any point.

Notes:
(i) RS485 can only be used with software release Ver. 4.02 onwards.
(ii) RS485 Data Hi-way is not compatible with RS422 Data Hi-way devices such as IN-2000-AI, IN-2000-AO, IN-2000-DI, IN-2000-DO, FP21, SR25, etc. Use a 2100-4S to interface an RS485 Data Hi-way to an existing RS422 Data Hi-way

**RS232:** 2100-IS convertor is not required to connect the 2100-232 directly to a PC. Use the RS232 kit to connect the 2100-232 directly to a PC. The PC requires one RS232 port per 2100.

**RS485:** If the outstation is using RS485, it cannot be connected to the same data hi-way as an outstations using RS422. In the 'programming' box, set the 'TX delay' box to 20. Set the Dip switches on the 2100-IS and the jumpers on the 2100 for RS485 operation.

## *OUTSTATION LAYOUT. 4-Wire RS422 Serial Connections.*




IMPORTANT:
(i) All cables must be screened.
(ii) All screens must be connected together.
(iii) The screen must not be earthed at any point.

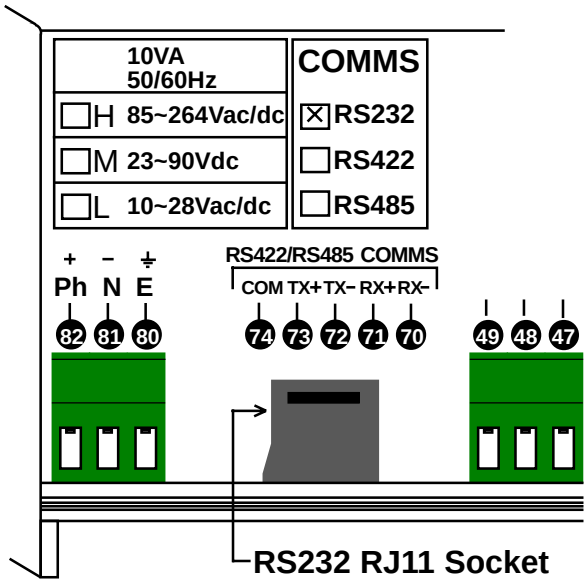
## *2100-AO RS232 Serial Connection.*

**The 2100-AO with RS232 comes complete with:**

- **1 x 5m RJ11 RS232 Cable. (2, 10 & 15m available.)**
- **1 x 9 Pin D-type Connector. (25 pin D-type available.)**
- **USB to RS232 convertor available. Part No. BF-810.**

**RS232 COMMS Hardware.**

## *Location of RJ11 Socket on 2100-AO Series.*




| COMMS Pinout Table | | |
|---|---|---|
| **RJ11** | **DB9** | **DB25** |
| 1:RTS | 8 | 5 |
| 2:GND | 5 | 7 |
| 3:TX | 2 | 3 |
| 4:CTS | 7 | 4 |
| 5:n/c | 1 | 1 |
| 6:RX | 3 | 2 |

## *Installation.*

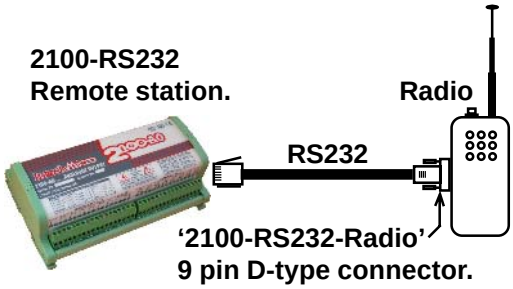
Plug one end of the RS232 Comms cable into the RS232 RJ11 Socket on the 2100 Module. Plug the other end into either the 9 or 25 pin D-type connector. (Check for the correct D-type connector on the computer (or Omron PLC) RS232 port being used.) For further software and hardware information, Refer to the Microscan Manual 'Programming the 2100 Series Remote Station.'

## *2100-RS232 Kit-Omron*

RS232 Kit for Omron PLC. Includes 2m cable & 9 pin D-type connector.

## *2100-AO RS232 Radio Modem Serial Connection.*

Note: The '2100-RS232-Radio' 9 pin D connector differs from the 2100-RS232 9 pin D supplied, and must be ordered seperately. It can be exchanged at no charge for the 9 pin and 25 pin D connectors supplied with the 2100-RS232 Remote Station.




1. Refer to Installation paragraph above.
2. Fit the '2100-RS232-Radio' 9 pin D connector between the Radio end of the RS232 comms cable, and the Radio. This connector will work with most types of radio, but this is not guaranteed. Pin2=TX; Pin3=RX; Pin5=GND; Pin7=RTS.
3. Refer to 'H2 Comms Settings.' to jumper as per RS232 Radio.
4. Refer to radio manual for hardware handshaking settings for TX control. TXE & TX delay may need to be altered in the Scada Station Advanced Dialog box to suit the radio. Best case TX speed is one transmission per second. (Depends on Radio.) Default settings are: TXE = 25ms; TX = 0ms.
5. If using more than one station at a remote radio site, **2100-RS422** Remote Stations with a 2100-IS with an adaptor kit must be used. (Do not use 2100-RS485.) Refer to 2100-IS installation Guide.

## *2100-AO Station Number Programming and Serial Number.*

**Important:** When commissioning remote stations, you must programme a unique station number before using the programme setup button in the Scada Software. Requires Microscan Version 4.02 onwards.
For detailed programming info, refer to 'Programming 2100-Series Remote Station' in the Microscan Manual.

1. Close the Microscan Scada down and turn the power off to the 2100 422/485 converter. Connect the new Remote Station, referring to '*Wiring and Installation*' and '*Commissioning*'
2. Turn power back on to the 2100 422/485 converter, and start the 'Setup Manager' in the Microscan Scada.
3. Select 'Recorder Setup', or 'Tag Setup'.
4. Select 'Program Address'. (Located in 'Station Programming Panel', at the bottom right of the window.
5. Enter the 2100-AO serial number. (Written both on the 2100-AO cover and the circuit board behind the power supply terminals. 80, 81 & 82. If the cover has been removed, the number on the circuit board is always correct. Replace with the correct cover to avoid future confusion.) Then enter the desired station number.
6. Select 'Program'. The station number will now be stored in 2100-AO permanent memory.
7. A new station number will be created on the outstation map. This is ready for connection to tags or lines.
8. Restart the Microscan Scada.

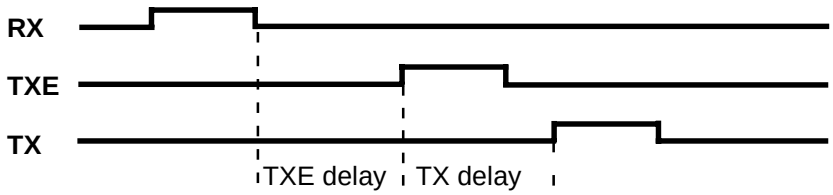
## *2100-AO Station Software Programming.*

*Requires Microscan Version 4.02 onwards.

1. If the system is already running, close the Scada down. Start the 'Setup Manager'.
2. Select 'Recorder Setup', or 'Tag Setup'.
3. Move to the required station number, using 'next' or 'prev' buttons.
4. Select 'Program Setup'. The serial number of the 2100-AO will be recalled automatically. The software recalls the settings from the outstation, and displays them in the dialogue box.
5. Enter the required options and select 'Program' to write the data to the station.

### *2100-AO TXE and TX Delay Settings.*

The TXE and TX delays are software selectable in the MicroScan Outstation Programming Box. These delays are used for RS485/RS232 operation, to control the behaviour of the transmitter on the outstation, when it is ready to send data. The TXE delay controls how long the transmitter waits before turning on. The TX delay controls how long the transmitter waits before sending data. If the TXE delay is zero, the transmitter turns on immediately. If the TX delay is zero, the data is sent immediately, upon receiving a command.




The period is specified in units of 2.5ms.
i.e. 10units = 25ms

### *2100-AO Delay Settings Table.*

| COMMS Delays Units (time) | | |
|---|---|---|
| **Protocol** | **TXE Delay** | **TX Delay** |
| RS232 - to suit radio | 10 (25ms) | 20~200 (50~500ms) |
| RS422 | 10 (25ms) | 0 |
| RS485 | 10 (25ms) | 0 |

Note. All TXE and TX Delays are Software Selectable. The Factory Default TXE Setting is 10(25ms).

## *Section E. Connecting to a PLC.*
## *Eight Analogue Outputs Generated from PLC Digital Outputs.*

### *Description.*

The 2100-AO can be used to generate up to eight cost effective analogue outputs by only using PLC's digital outputs.
For example eight 12bit analogue outputs can be generated with only 7 PLC digital outputs. (4 data bits, strobe, clock and Reset.)

For each 2100-AO added to the system, only one more digital output is required. (Strobe)

| 2100-AO Control Signals | | |
|---|---|---|
| **Digital Input** | **Data Entry and Channel Selection** | |
| | **Clock/Reset** | **Binary** |
| DI 1 | Data Bit 1, LSB | Data Bit 1, LSB |
| DI 2 | Data Bit 2 | Data Bit 2 |
| DI 3 | Data Bit 3 | Data Bit 3 |
| DI 4 | Data Bit 4, MSB | Data Bit 4, MSB |
| DI 5 | Data Bit 5, LSB | Data Bit 5, LSB |
| DI 6 | Data Bit 6 | Data Bit 6 |
| DI 7 | Data Bit 7 | Data Bit 7 |
| DI 8 | Data Bit 8, MSB | Data Bit 8, MSB |
| DI 9 | Reset | Binary 1 |
| DI 10 | Clock | Binary 2 |
| DI 11 | | Binary 4 |
| DI 12 | Strobe | Strobe |

### *Writing Data.*

An analogue output channel is selected. (Refer Channel Selection below.) Data bits are presented to the digital inputs. A strobe pulse is used to enter the data inputs. (The mode selected as described below will determine the number of data bits and strobe pulses.) When the final data bits are presented, and the final strobe pulse is issued, the data is written to an analogue output and the 'WRITE OK" LED will light. A new analogue output can be selected or the write sequence repeated.
Note 1. The PLC must allow enough time for the digital inputs to stabilise before issuing a strobe pulse.
Note 2. The strobe pulse must be long enough to satisfy the Control Signal Debounce. (Refer next page.)

## *Data Entry Modes*.

Data entry has two configuration options:

(i) Channel Selection. This determines channel selection method.

(ii) Data bit Input. This determines resolution and how the data is written to the analogue output.

**(i) Channel Selection.**

**Mode A: Clock / Reset Channel Selection.**

DI 9 = Reset Pulse. To reset to channel 1 issue a Reset Pulse.

DI 10 = Clock Pulse. To advance to the next channel, issue a Clock Pulse.

Channels may be skipped by issuing several Clock/Reset pulses in sequence.
The test dialog box can be used to see what channel is currently selected.

**Mode B: Binary Channel Selection.**

The address on DI 9, DI 10 and DI 11 are used as a binary address to select the channel.
The binary address must be set up by the PLC before the Strobe Pulse is issued.

| 2100-AO Binary Signals | | | |
|---|---|---|---|
| **Analogue Output Channel** | **DI 9 / Binary 1** | **DI 10 / Binary 2** | **DI 11 / Binary 4** |
| 1 | 0 | 0 | 0 |
| 2 | 1 | 0 | 0 |
| 3 | 0 | 1 | 0 |
| 4 | 1 | 1 | 0 |
| 5 | 0 | 0 | 1 |
| 6 | 1 | 0 | 1 |
| 7 | 0 | 1 | 1 |
| 8 | 1 | 1 | 1 |

The test dialog box can be used to see what channel is currently selected.

**(ii) Data Bit Input.**

Resolution of 4bits = 16steps (Mode 1, 1 Strobe)
Resolution of 8bits = 256steps (Mode 2, 2 Strobes) or (Mode 4, 1 Strobe)
Resolution of 12bits = 4096steps (Mode 3, 3 Strobes)

**Mode 1. 4 Bit DI 1 ~ DI 4, One Strobe.**

The data is set up on inputs DI 1 to DI 4, and a strobe pulse is issued.
The data is loaded to the analogue output, and the 'WRITE OK' LED flashes.
A new channel can be selected, or the write sequence repeated.

**Mode 2. 8 Bit DI 1 ~ DI 4, Two Strobes.**

The High 4 bits of data is set up on inputs DI 1 to DI 4, and the first strobe pulse is issued.
The Low 4 bits of data is set up on inputs DI 1 to DI 4, and the second strobe pulse is issued.
The data is loaded to the analogue output, and the 'WRITE OK' LED flashes.
A new channel can be selected, or the write sequence repeated.
If a reset or clock pulse is issued before the second strobe is issued, the write will be cancelled.

**Mode 3. 12 Bit DI 1 ~ DI 4, Three Strobes.**

The High 4 bits of data is set up on inputs DI 1 to DI 4, and the first strobe pulse is issued.
The Middle 4 bits of data is set up on inputs DI 1 to DI 4, and the second strobe pulse is issued.
The Low 4 bits of data is set up on inputs DI 1 to DI 4, and the third strobe pulse is issued.
The data is loaded to the analogue output, and the 'WRITE OK' LED flashes.
A new channel can be selected, or the write sequence repeated.
If a reset or clock pulse is issued before the second strobe is issued, the write will be cancelled.

**Mode 4. 8 Bit DI 1 ~ DI 8, One Strobe.**

The 8 bits of data is set up on inputs DI 1 to DI 8, (low bits DI 1~DI 4, high bits DI 5~DI 8) and the strobe pulse is issued.
The data is loaded to the analogue output, and the 'WRITE OK' LED flashes.
A new channel can be selected, or the write sequence repeated.

**Control Signal Debounce.**

The debounce allows for noisy signals to be rejected from the 2100-AO control lines.
Selections are: NONE; 2.5msec; 5msec; 10msec; 25msec; 50msec; 100msec; & 200msec.
The signal is actioned on the first transition from low to high. (LED off to LED on) Any further transitions during the selected time period will be rejected. If the 2100-AO is communicating via COMMS to the MicroScan or the station is being programmed, approximately 50msec extra must be allowed for the serial messaging to be processed.
The Clock, Reset and Strobe signals all fall under this timing requirement.

## *Examples of Channel Selection Sequences.*

Note: Small delay refers to delay as set by Control Signal Debounce.

**1. 4 bit output, Clock/Reset channel selection.**

* PLC Input Selection = Mode A: Clock/Reset channel selection.
* Data input size = Mode 1: 4 bit DI 1~DI 4, One strobe.

1. Power up or start up. Issue a Reset pulse.
2. Load the data for the channel to bits DI 1~DI 4.
3. Small delay.
4. Turn Strobe on.
5. Small delay.
6. Turn Strobe off. Data written to output and the 'WRITE OK' LED flashes.
7. Issue Clock to advance to the next channel or issue a Reset to go back to channel 1.

**2. 8 bit output, Clock/Reset selection.**

* PLC Input Selection = Mode A: Clock/Reset channel selection.
* Data input size = Mode 2: 8 bit DI 1~DI 4, Two strobes.

1. Power up or start up. Issue a Reset pulse.
2. Load the high data bits for the channel to bits DI 1~DI 4.
3. Small delay.
4. Turn Strobe on.
5. Small delay.
6. Turn Strobe off.
7. Load the low data bits for the channel to bits DI 1~DI 4.
8. Small delay.
9. Turn Strobe on.
10. Small delay.
11. Turn Strobe off. Data written to output and the 'WRITE OK' LED flashes.
12. Issue Clock to advance to the next channel or issue a Reset to go back to channel 1.

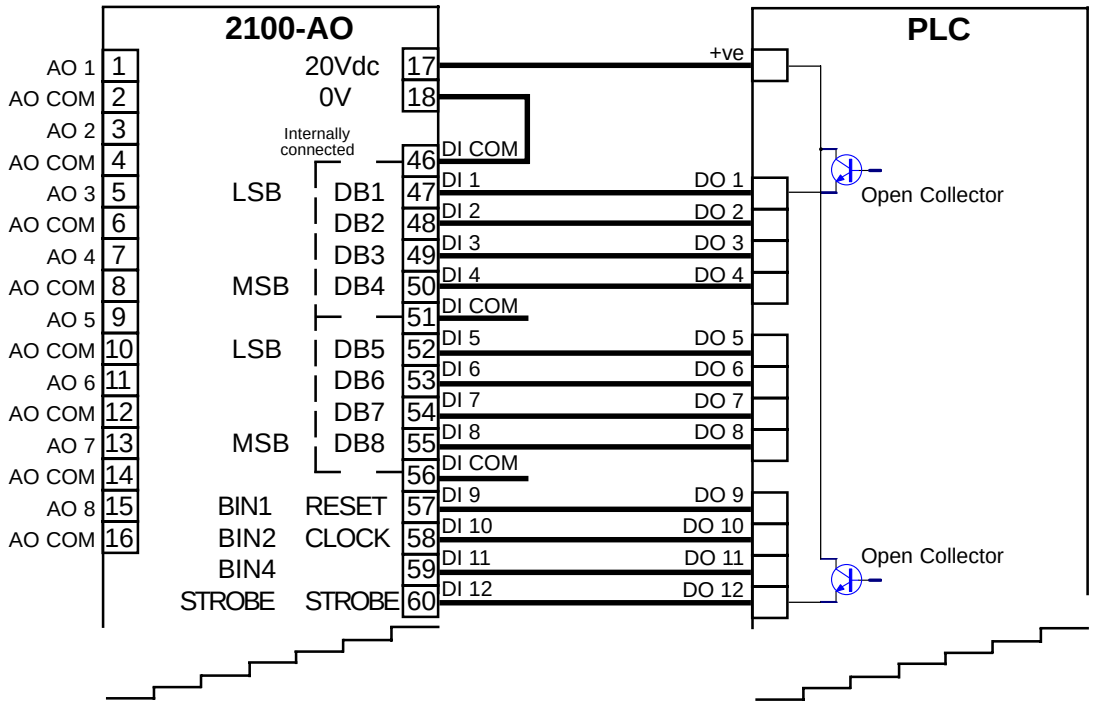
**3. 4 bit output, BCD selection**

* PLC Input Selection = Mode B: BCD channel selection.
* Data input size = Mode 1: 4 bit DI 1~DI 4, One strobe.

1. Set the BCD address for the channel on DI 9~DI 11.
2. Load the data for the channel to bits DI 1~DI 4.
3. Small delay.
4. Turn Strobe on.
5. Small delay.
6. Turn Strobe off. Data written to output and the 'WRITE OK' LED flashes.
7. Set the BCD address for the another channel.

## *2100-AO and PLC Connection Example 1.*

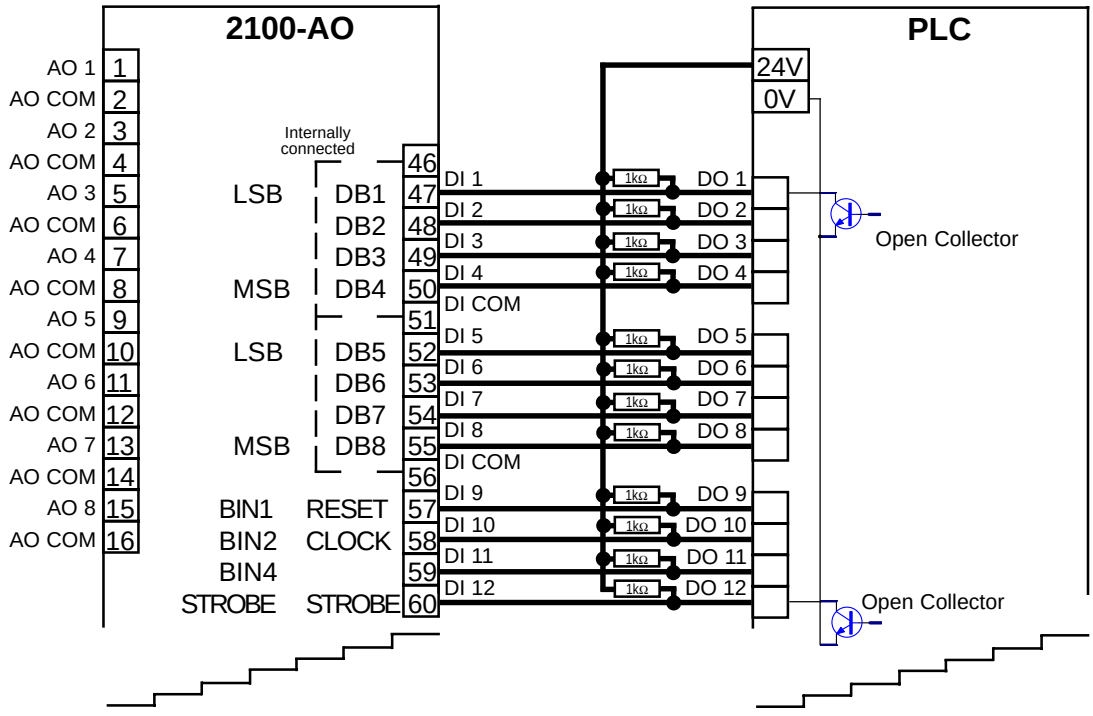
**2100-AO analogue outputs driven by PLC digital outputs with commoned +ve open collectors.**




Note 1. For Mode A, & Modes 1 or 2 or 3, PLC requires 7 digital outputs: DO 1~DO 4 & DO 9, DO 10 & DO 12.
Note 2. For Mode B, & Modes 1 or 2 or 3, PLC requires 8 digital outputs: DO 1~DO 4 & DO 9~DO 12.
Note 3. For Mode A, & Mode 4, PLC requires 11 digital outputs: DO 1~DO 4, DO 5~DO 8 & DO 9, DO 10 & DO 12
Note 4. For Mode B, & Mode 4, PLC requires 12 digital outputs: DO 1~DO 4, DO 5~DO 8 & DO 9~DO 12.
Note 5. Using the 2100-AO 20Vdc P/S negates the digital input to analogue input/output isolation.

## *2100-AO and PLC Connection Example 2.*

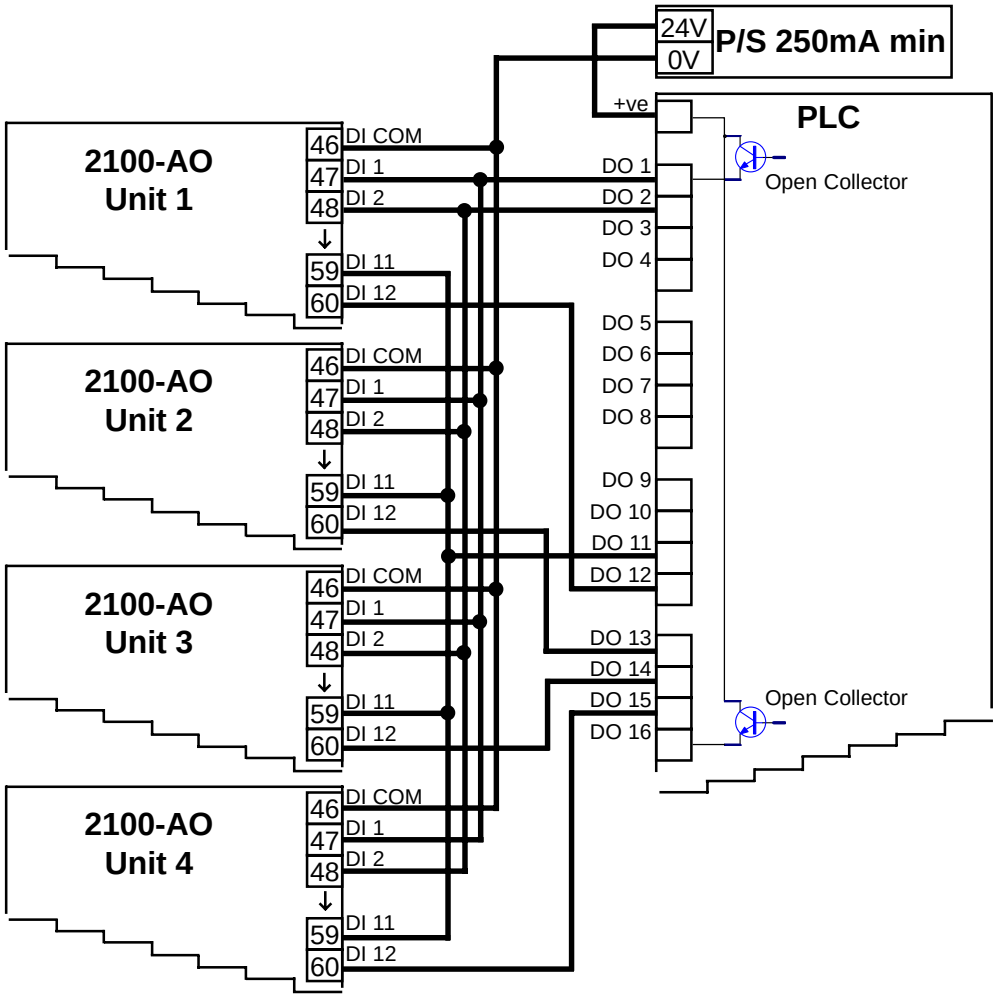
**2100-AO analogue outputs driven by PLC digital outputs with commoned 0V open collectors.**
**Important: Reverse logic for Digital Outputs.**




Note 1. For Mode A, & Modes 1 or 2 or 3, PLC requires 7 digital outputs: DO 1~DO 4 & DO 9, DO 10 & DO 12.
Note 2. For Mode B, & Modes 1 or 2 or 3, PLC requires 8 digital outputs: DO 1~DO 4 & DO 9~DO 12.
Note 3. For Mode A, & Mode 4, PLC requires 11 digital outputs: DO 1~DO 4, DO 5~DO 8 & DO 9, DO 10 & DO 12
Note 4. For Mode B, & Mode 4, PLC requires 12 digital outputs: DO 1~DO 4, DO 5~DO 8 & DO 9~DO 12.
Note 5. Using the 2100-AO 20Vdc P/S negates the digital input to analogue input/output isolation.
Note 6. Using 1k resistors the PLC can drive upto 4 2100-AO in parallel. To drive more, reduce the value of the resistors. At 24Vdc each resistor uses 24mA. Thus in the case of Note 1, 7 digital outputs will use 168mA. Ensure that the P/S can handle the load of any connection configuration chosen.

## *2100-AO and PLC Connection Example 3.*

**Parallel Connection of multiple 2100-AO control signals driven by PLC digital outputs with commoned +ve open collectors.**




Note 1. For each extra 2100-AO the PLC requires one extra digital output to drive the strobe input. As long as the strobe input is held low the 2100-AO ignores data on any other digital inputs. So in this connection example if Mode A and Modes 1 or 2 or 3 were used then the PLC would require 10 digital outputs. (6 paralleled digital inputs, and 1 strobe per 2100-AO.)

Note 2. This connection example requires a 24Vdc, 250mA P/S minimum.
At 24Vdc each digital input draws 9.6mA. 4 units, with 6 parallel lines, plus 4 strobes = 28 digital inputs.
28 x 9.6mA = 250mA approx.
**Do not use the 2100-AO 20Vdc 100mA maximum P/S.**

## *2100-AO. Eight Analogue Inputs Multiplexed to One Analogue Output.*

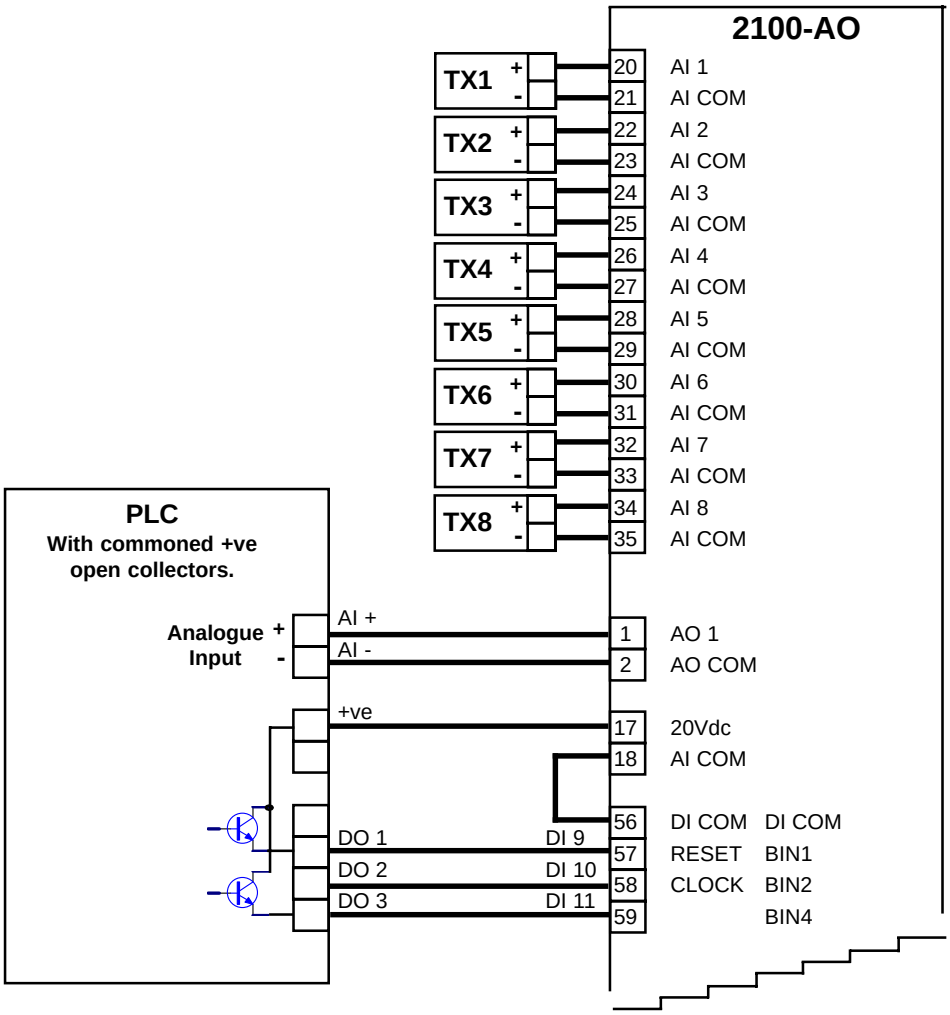
### Description.

The 2100-AO can multiplex up to eight analogue inputs to one analogue ouput by using only two PLC digital outputs (Clock and Reset) and one PLC analogue input. For each 2100-AO added to the system only one more PLC analogue input is required.

### Procedure.

Select the analogue input channel. (Refer page 14, Mode A or Mode B channel selection.)
The analogue input is loaded to analogue output 1. (No strobe is required.)
A new analogue input channel can be selected.

### PLC Connection Example.




Note 1. For Mode A, PLC requires 2 digital outputs.
Note 2. For Mode B, PLC requires 3 digital outputs.
Note 3. For PLC with commoned 0V open collectors refer Connection Example 2 on page 16.
Note 4. Using 2100-AO 20Vdc P/S negates the digital input to analogue input/output isolation.

**CAUTION: Dangerous voltages may be present. The 2100-AO has no user serviceable parts.**
**Protective enclosure only to be opened by qualified personnel.**
**Remove ALL power sources before removing protective cover.**

## *2100-AO. One Analogue Input Demultiplexed to Eight Analogue Outputs.*

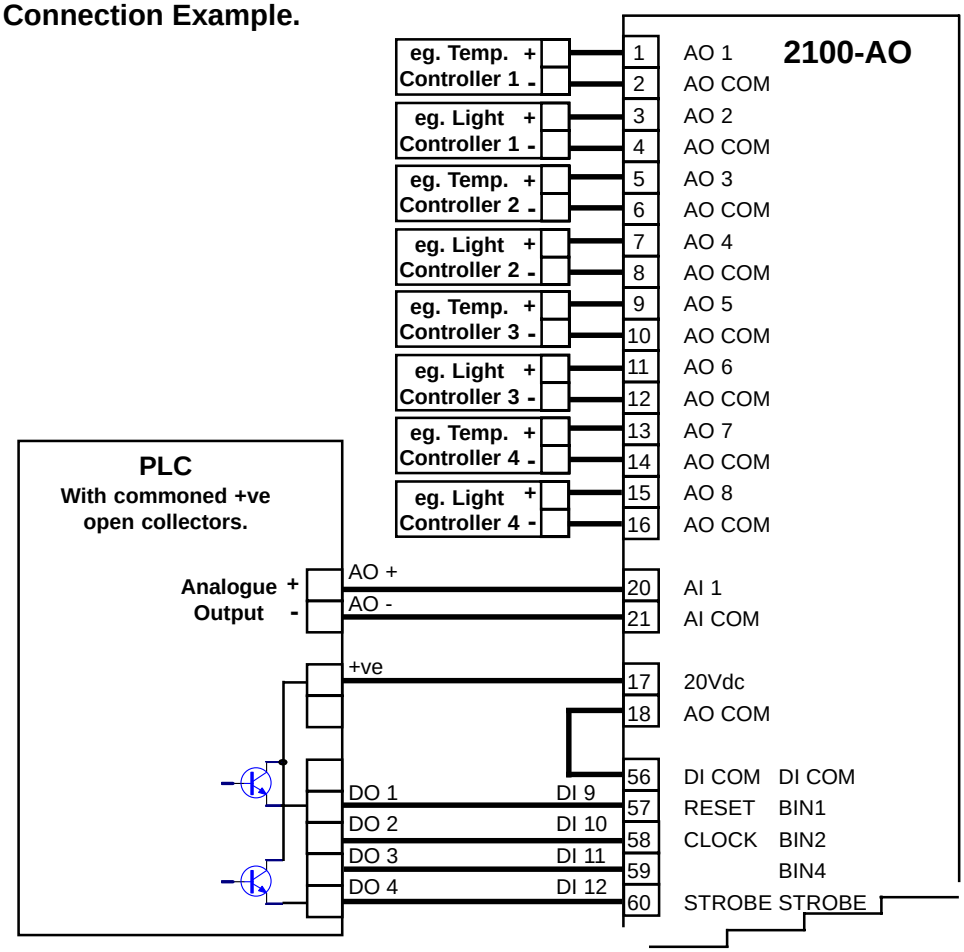
### Description.

The 2100-AO can be used to generate up to eight cost effective analogue ouputs. The PLC only requires three digital outputs (Clock, Reset & Strobe) and one analogue output for the 2100-AO to demultiplex the one PLC analogue output to eight analogue outputs. For each 2100-AO added to the system only one more digital output (Strobe) is required. If multiple 2100-AOs are used then all digital inputs and outputs must be isolated from all analogue inputs and outputs.

### Procedure.

Select the analogue output channel. (Refer page 14, Mode A or Mode B Channel Selection.)
Set analogue input 1 to the appropriate value and issue a strobe pulse.
The analogue channel is loaded to the analogue output and the 'WRITE OK' LED flashes.
A new channel can be selected., or the write sequence can be repeated.

### PLC Connection Example.




Note 1. For Mode A, PLC requires 3 digital outputs.
Note 2. For Mode B, PLC requires 4 digital outputs.
Note 3. For PLC with commoned 0V open collectors refer Connection Example 2 on page 16.
Note 4. Using 2100-AO 20Vdc P/S negates the digital input to analogue input/output isolation.

## *Communication Protocols.*

**PLC Message.**

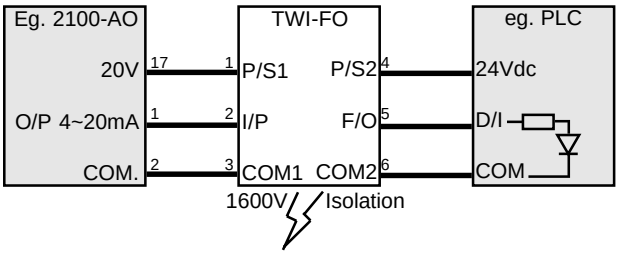
'Read Only From 2100-AO' and 'Read and Write to 2100-AO' Protocols are both available from Intech Instruments in 'WORD' format, free of charge.

Read Message is PLC compatible read DM area (AI1 to AI8 only). 2100-AO protocol is the protocol used by Microscan to access data in stations. Both protocols use ASCII, except 2100-AO uses IEEE754 to represent floating point numbers.

## *Analogue Signal Converted to Frequency for a PLC, using a TWI-FO.*

**Description.**

The TWI-FO converts 4~20mA from a 2100-AO to a frequency output. (Typically 10~1010Hz, but this is rangeable.) A PLC with two digital outputs (Clock and Reset) and one digital input can receive eight multiplexed analogue inputs.



## *Section F. Wiring and Installation and Maintenance.*

**THE 2100-AO IS TO BE INSTALLED AND SERVICED BY SERVICE PERSONNEL ONLY. NO OPERATOR / USER SERVICEABLE PARTS.**
All power and signals must be de-energised before connecting any wiring, or altering any Jumpers or Dip Switches. Do not start the Microscan before programming in a unique station number. Refer 'Station Number Programming and Serial Number'.

**Mounting.**
* Also refer to Connection Diagrams and Notes.
(1) Mount in a clean environment in an electrical cabinet on 35mm Symmetrical mounting rail.
(2) Draft holes must have minimum free air space of 20mm. Foreign matter must not enter or block draft holes.
(3) Do not subject to vibration or excess temperature or humidity variations.
(4) Avoid mounting in cabinets with power control equipment.
(5) To maintain compliance with the EMC Directives the 2100-AO is to be mounted in a fully enclosed steel fire cabinet. The cabinet must be properly earthed, with appropriate input / output entry points and cabling.

**Cover Removal and Fitting.**
To remove 2100 covers, firmly push down the button in the middle of one endplate, and pull the end plate outwards, while pulling the cover up and out.
To fit the cover, first make sure the cover is being fitted the correct way around, (Terminal 82 on the cover is above 82 on the board.) and that the serial number on the board matches the serial number on the cover (if applicable). Slide one end of the cover into the slot in the endplate. Pull the other endplate outwards and push the cover down until it slides into the slot of this endplate. Check both ends are firmly held.

**Power Supply Wiring.**
(1) A readily accessible disconnect device and a 1A, 250Vac overcurrent device, must be in the power supply wiring.
(2) Any 2100-R connected to the 2100-AO, must share the same disconnect device and overcurrent device
(3) For power supply, connect Phase (or +ve) to terminal 82, Neutral (or -ve) to 81, and Earth to 80. To ensure compliance to CE Safety requirements, the grey terminal insulators must be fitted to ALL mains terminals after wiring is completed. (ie. Terminals 82, 81 and 80.) For Non Hazardous Voltage power supplies (not exceeding 42.4Vpeak or 60Vdc) terminals 81 and 80 may be linked together, instead of connecting an earth.

**RS422/485 Comms Signal Cabling.**
(1) Use only low capacitance, twisted pair, overall screened data cable. The cable must equal or better the following specifications.

| **Cable Specifications.** | | |
|---|---|---|
| Conductor Size. | | 7/0.20mm, 24AWG |
| Conductor Resistance @ 20C. | | 8.9Ω/100m |
| Max. Working Voltage. | | 300Vrms |
| Capacitance between wires of a pair. | | 50ρF/m |
| Capacitance between each wire to all others bunched together. | | 95ρF/m |
| Cross-talk between pairs: | @ 1kHz<br>@ 100kHz | >-90dB/100m<br>>-50dB/100m |
| Characteristic Impedance . | @ 100kHz | 135Ω |
| Attenuation of a pair: | @ 1kHz<br>@ 10kHz<br>@ 100kHz<br>@ 50kHz<br>@ 1MHz<br>@ 1.5MHz | 0.15dB/100m<br>0.42dB/100m<br>0.8dB/100m<br>0.9dB/100m<br>1.9dB/100m<br>2.4dB/100m |

**NOTE:** All cables are to be subject during manufacture to in-process spark testing @ 4kVrms.
All cables are to be tested between conductors and conductors to screen for 1min @ 1500Vrms.

(2) Minimum cable pairs: RS422 = 2. (Plus overall screen.) RS485 = 1. (Plus overall screen.)
(3) Take care not to stress or damage cables during installation.
(4) Total length of trunk line, including spurs, is not to exceed 1200m without isolating boosters.
(5) Terminating resistors -1kΩ.
(6) Cabling paths should avoid sources of radio frequency interferences such as fluorescent lights, variable speed motor drives, welding equipment, radio transmitters, etc.
(7) There should be a minimum of 200mm physical separation between power cables and data cables.
(8) Data cables should not be exposed to excessive heat or moisture, and should not be buried directly in the ground without protection.
(9) Avoid powering a remote station or controller from the same power supply as a variable speed drive.
(10) All unused twisted pairs should be terminated at both ends with 1kΩ resistors. DO NOT ground unused pairs.

**Analogue Signal Wiring.**

(1) All signal cables should be good quality overall screened INSTRUMENTATION CABLE with the screen earthed at one end only.
(2) Signal cables should be laid a minimum distance of 300mm from any power cables.
(3) For 2 wire current loops, 2 wire voltage signals or 2 wire current signals, Austral Standard Cables B5102ES is recommended. For 3 wire transmitters and RTDs Austral Standard Cables B5103ES is recommended.
(4) It is recommended that you do not ground analogue signals and use power supplies with ungrounded outputs.
(5) Lightning arrestors should be used when there is a danger from this source.
(6) Refer to diagrams for connection information.

## *2100-AO Commissioning.*

(1) Check the 2100-AO has been set up to the right input and output ranges, and that it's new ranges have been checked.
(2) Once the above conditions have been met, and the wiring checked, apply power to the 2100-AO, the loops, sensors, 2100-Rs. Allow a 5 minute warm-up period.

Note 1. There is a 15sec initialisation period when the 2100-AO is powered up, before it will communicate.
Note 2. For maximum accuracy allow a 1 hour warm up period.

(3) Take a reading of the value being measured on each channel, and ensure that this agrees with the level being indicated by the Data Logger, PLC or control equipment etc for that channel. Adjust for any differences in the software of the system.

## *2100-AO Maintenance.*

**Voltage and Current Inputs and Outputs.**

(1) Repeat (2) and (3) of commissioning. Do it regularly - at least once every twelve months.

# NOTES

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