EUROTHERM DRIVES

# Johnson Controls Metasys N2 Communications Interface

## Technical Manual

HA470901 Issue 1

Compatible with Version 1.x Software

# Safety Information

**Please read this information BEFORE installing the equipment.**

## Intended Users

This manual is to be made available to all persons who are required to install, configure or service equipment described herein, or any other associated operation.

The information given is intended to highlight safety issues, and to enable the user to obtain maximum benefit from the equipment.

## Application Area

The equipment described is intended for industrial motor speed control utilising AC induction or AC synchronous machines.

## Personnel

Installation, operation and maintenance of the equipment should be carried out by qualified personnel. A qualified person is someone who is technically competent and familiar with all safety information and established safety practices; with the installation process, operation and maintenance of this equipment; and with all the hazards involved.

**REFER TO YOUR MAIN PRODUCT MANUAL FOR SPECIFIC SAFETY INFORMATION ABOUT THE DEVICE YOU ARE CONTROLLING**



Cont.2

# Contents

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# JOHNSON CONTROLS N2 TECHNOLOGY OPTION

## A System Overview

The Johnson Controls N2 Technology Option provides a serial data port, allowing VSDs (variable speed drives) to be linked to form a network. Using a Network Control Module, this network can be continuously controlled to provide supervision and monitoring for each VSD in the system.

With each unit under local control, the central supervisor performs only periodic setpoint updating, control sequencing and data collection.

In the system, the Network Control Module acts as the Master, and the VSD as the Slave.

The network of VSDs can be set-up using each unit's MMI/Operator Station.

**Advantages with this type of control system**

1. Multi-wire analog transmission from a central programmable controller is replaced by a bussed digital system using serial data transmission over differential twisted-pair wires.
2. Digital transmission is fundamentally less noise-prone than analog methods, and the accuracy of the transmitted data is unaffected by the transmission medium. The use of intelligent devices at either end of the data link allows error checking to be used. This virtually eliminates the effects of electrical noise on data integrity. It is therefore possible to issue setpoints to drives with much higher accuracy using this method.
3. The communication standard used allows up to 32 drives to be connected to a single link which can be driven from a computer serial port.
4. The chosen standard and protocol are compatible with other Eurotherm Group products. Temperature controls, process controls, data loggers and drives can communicate easily with a common supervisory system.

## Protocol

This card communicates using the Johnson Controls N2 protocol. Any connections made to it most comply with this protocol. All effort has been made to maintain compatibility with devices using this protocol.

## Product Features

- Suitable for use with:

  HVAC10 Drive Products software version 4.6 onwards

- Connection using 2-wire shielded twisted pair (RS485)
- Protocol tag access for defined N2 parameters

## Size Notation – Part Numbers

Size 1 HVAC10 drives use the 6053-JMET Metasys N2 Technology Box.

All Size 2 and 3 HVAC10 drives use the 6055-JMET Metasys N2 Technology Box.

**WARNING!**

Before installing, ensure that the drive and all wiring is electrically isolated and cannot be made "live" unintentionally by other personnel.

Wait 5 minutes after disconnecting power before working on any part of the system or removing the covers from the Drive.

# JOHNSON CONTROLS N2 Communication Module (HVAC10)

You can create a network of drives by linking a Master to one or more HVAC10 drives fitted with this module.

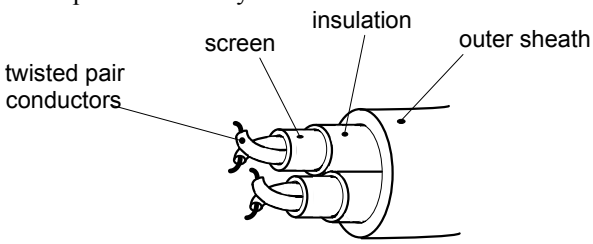
Plug this Communication Module on to the front of the HVAC10 drive by removing its terminal cover and fitting the product to the right-most Technology Box position.

Wiring is very simple - all connections are SELV (Safe Extra Low Voltage).

It is possible to establish serial communications without adhering to the following recommendations, however, the recommendations will promote greater reliability.

## Cable Specification

Use cable which has two twisted pairs, with each pair individually screened as shown. The characteristic impedance should be in the range 100 to 165 Ohms.




| Recommended Cable Specification | |
|---|---|
| Characteristic Impedance | 100-165Ω at 3-20MHz |
| Cable Capacitance | <30pF/m |
| Core Diameter | 0.34mm² (22 AWG) |
| Cable Type | Twisted pair cable |
| Resistance | <110Ω/km |
| Shielding | Copper braid, or braid & foil |

***Note:*** *One example: Belden B3079A cable meets the above specification.*

## Cable Routing

Daisy chain one drive to the next. The supervisor should be at one end of the run. Avoid spurs.

## Earthing/Grounding

Connect the screens of both pairs of wires to ground at the supervisor. If possible, connect the supervisor's transmitter/receiver 0V reference to earth. Connect all screens as shown in the following diagrams.

## User Connections to the Main Serial Port (N2)

The serial port on the Option allows the following JOHNSON CONTROLS N2 links to be made.

| | RS485 |
|---|---|
| Electrical Connections | 2-wire differential |
| Number of transmitters and transceivers allowed per differential pair of wires | 32 transceivers |
| Maximum cable length | 4000ft/1200 metres |

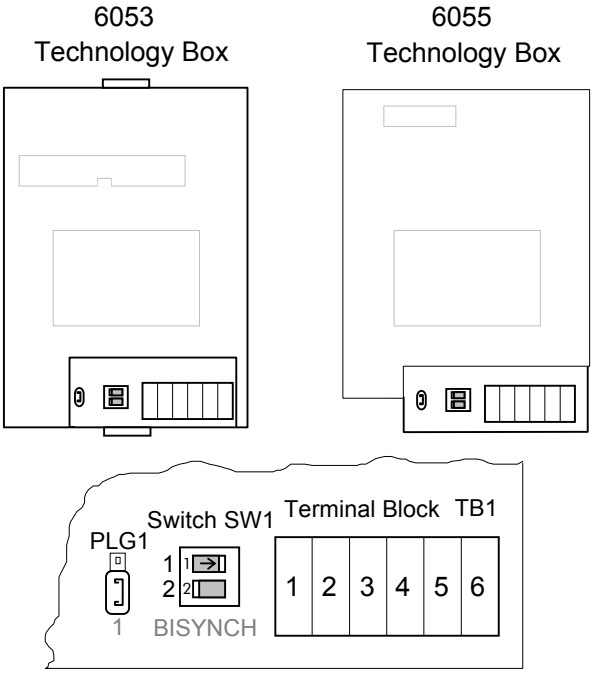
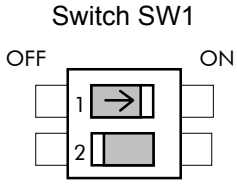



**Figure 1 Option showing Terminal Block TB1 and DIL Switch SW1**

## DIL Switch (SW1) Settings

Set this switch to select 2-wire operation, and to switch in a terminator for the last drive in the system.

| Switch | Status | Description |
|---|---|---|
| 1 | OFF<br>ON | 4-wire (Not Supported by Metasys)<br>2-wire |
| 2 | OFF<br>ON | Terminator out (default)<br>Terminator in |




## Terminators

- The unit logically furthest from the supervisor must have switch 2 set to ON.
- All other units in the system must have switch 2 set to OFF.

The supervisor's receiver input should also have a terminating resistor, chosen to match the characteristic impedance of the cable, typically 100 to 165 Ohms.

## Terminal Block (TB1) Connections

| Terminal No. | 2-Wire Designation |
|---|---|
| 1 | Not used |
| 2 | Not used |
| 3 | 0V |
| 4 | Cable Screen |
| 5 | N2- |
| 6 | N2+ |

# Fitting and Connecting to the Technology Box

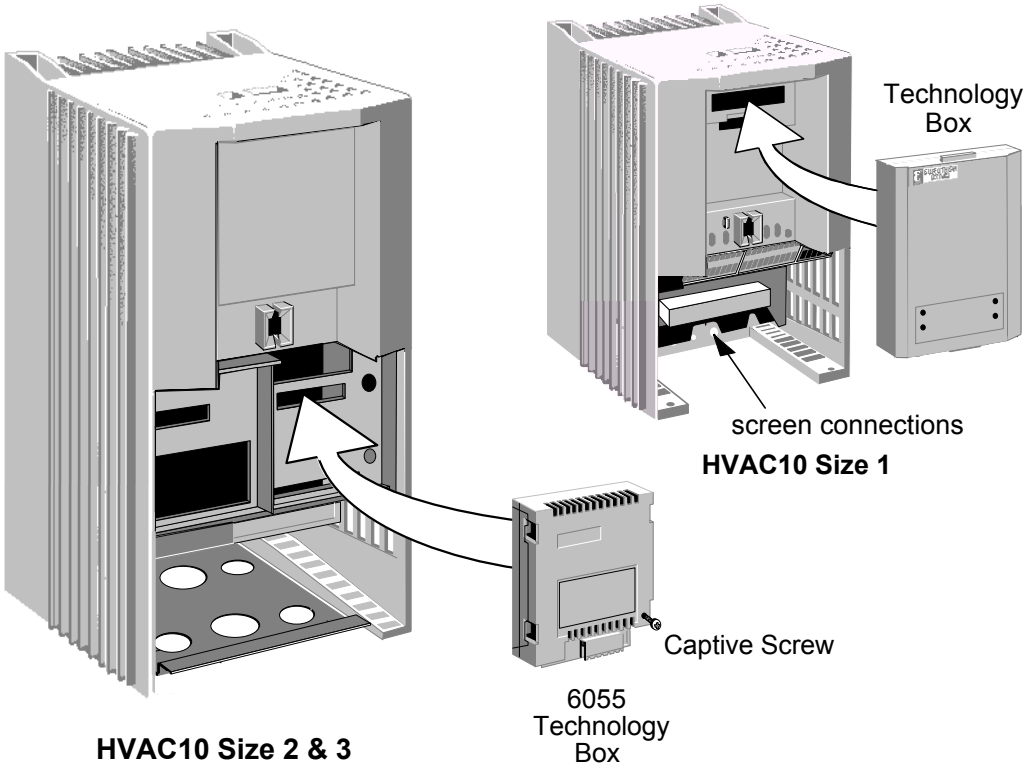



**Figure 2 Plug-in Technology Boxes**

**WARNING!**
Ensure that all wiring is isolated.

**IMPORTANT:** Remember to set the switch positions on the DIL switch, SW1.

The Technology Option plugs into the right-hand position on the front of the drive, or in place of the Operator Station/blank cover (SIZE 1 only).

It can be used with the Operator Station fitted, but for the HVAC10 SIZE 1 unit you must mount the Operator Station remotely using the Panel Mounting Kit with connecting lead (6052). The connecting lead enters the HVAC10 drive through the gland plate.

- Remove the terminal cover and screws.
- On the HVAC10 unit, plug the ribbon cable into the back of the Technology Box and into the socket on the drive.
- Click the Technology Box into place in the recess on the front of the drive. If provided, secure in position by tightening the captive screw on the bottom right hand corner of the Option. On the SIZE 1 unit it will protrude slightly above the standard plastic enclosure.
- Make all user wiring connections. Refer to the Wiring Diagrams**.**
- Re-fit the terminal cover securely with the screws.

## Wiring Diagrams

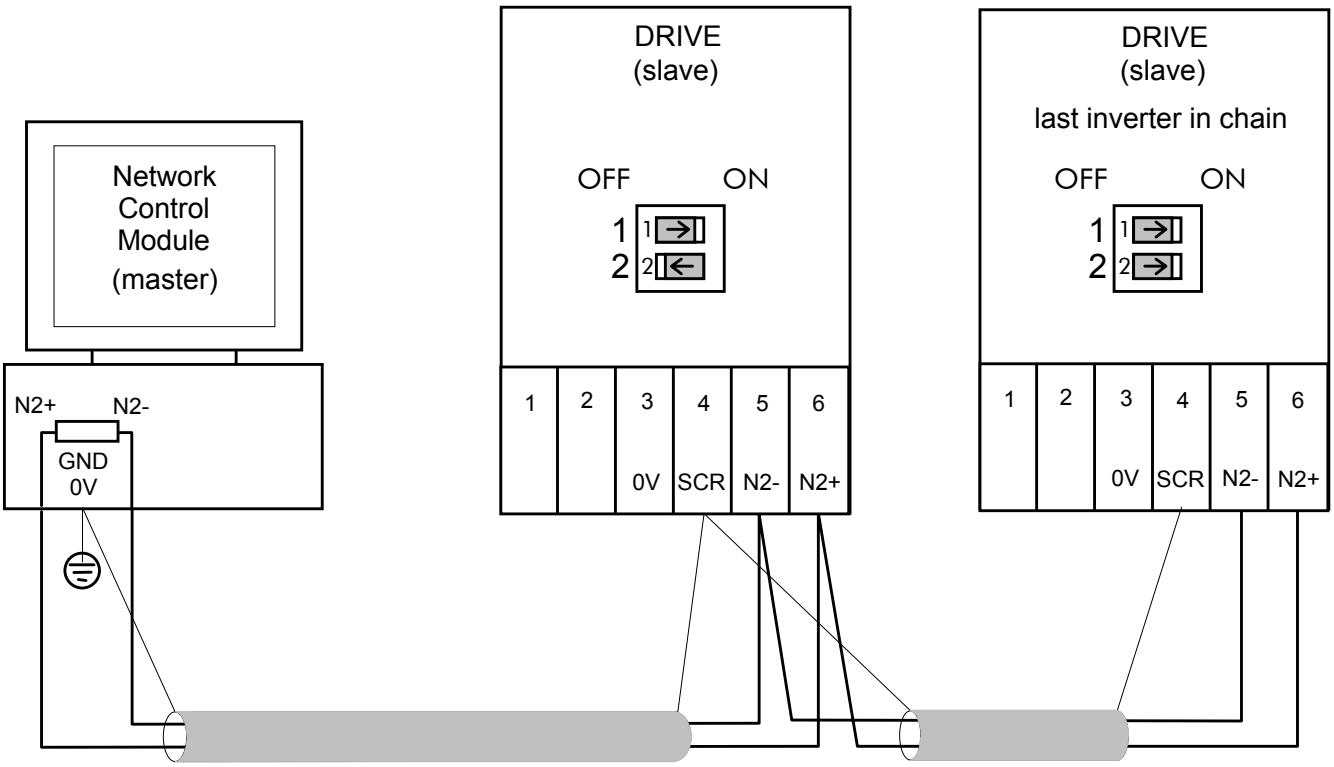



**Figure 3 2-Wire Wiring Diagram for the HVAC10 Size 2 & 3 Drive**

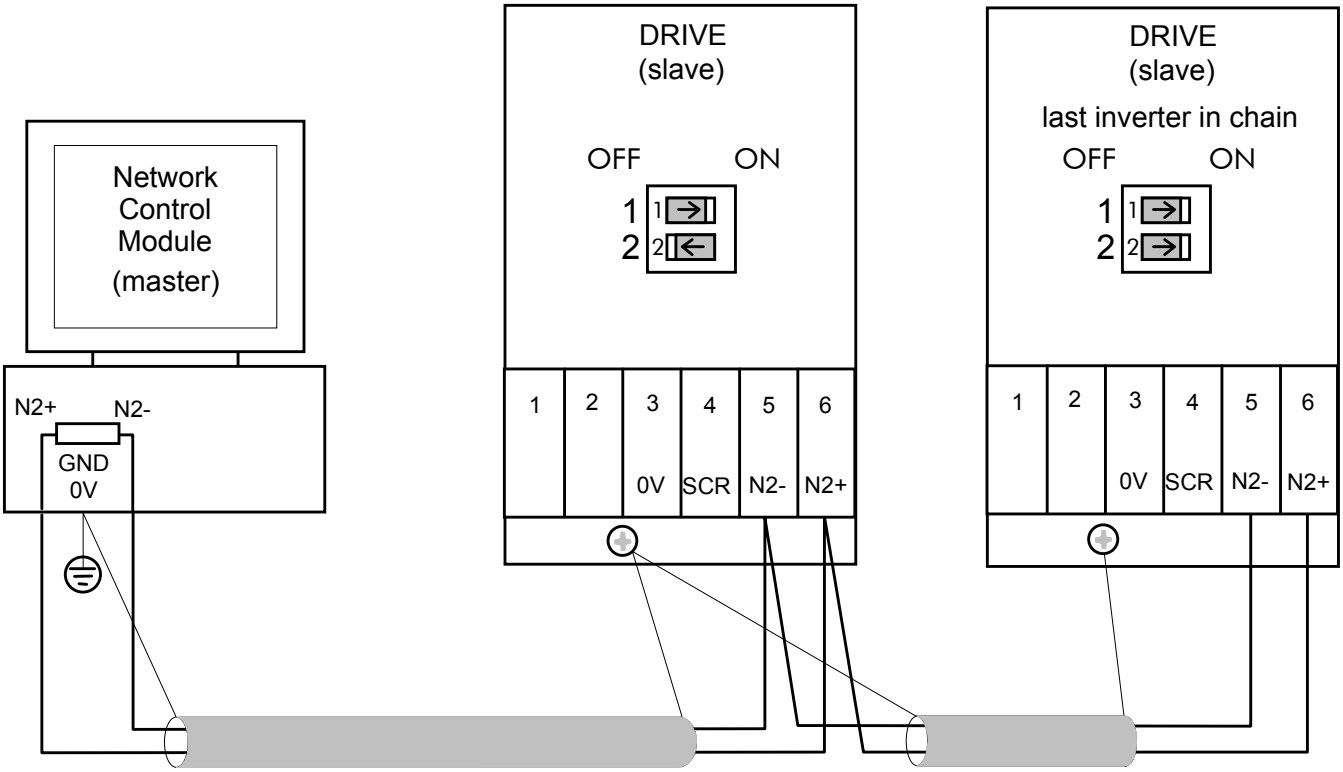



**Figure 4 2-Wire Wiring Diagram for the HVAC10 Size 1 Drive**

## Initial Check for Connection

With the correct connections to the active Network Control Module, the MODULE LED will be ON continuously and the NETWORK LED will indicate the IDLE state with a flash.

| | | |
|---|---|---|
| ON | | MODULE LED |
| FLASH | | NETWORK LED |

## Understanding the LED Indications

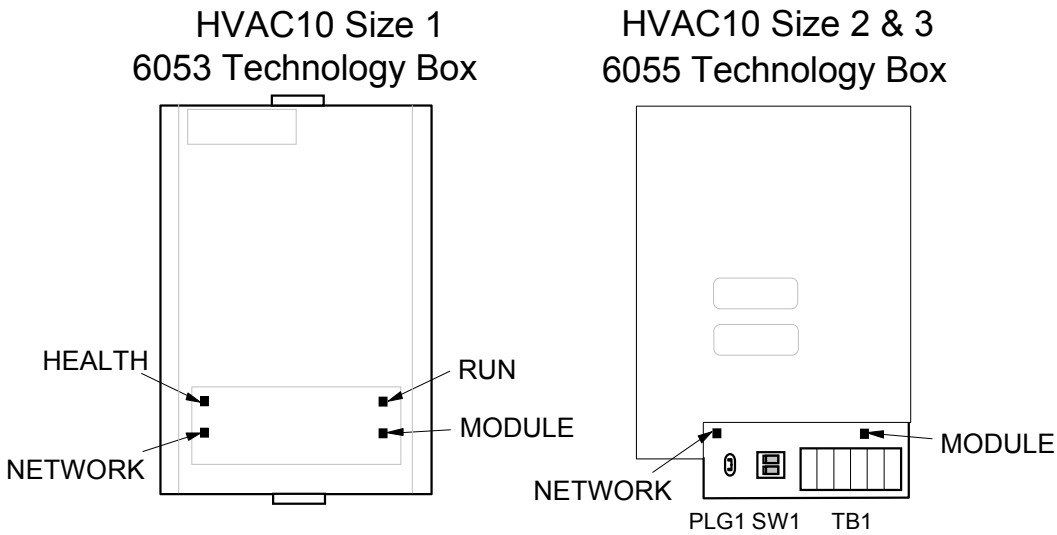



**Figure 5 Technology Option LEDs**

**HINT**:

The general rule for LED indications is

"ON IS GOOD, OFF IS BAD"

### Health and Run LEDs

#### HVAC10 Size 1 (6053) Technology Box

These LEDs reproduce the indications of the LEDs on the HVAC10 drive that are hidden when the Technology Box is fitted.

#### HVAC10 Size 2 & 3 (6055) Technology Box

The board does not have its own Health or Run LEDs. The LEDs are either on the Operator Station or blank cover.

### Module LED

This indicates the set-up state of the Technology Box. The states indicated are those produced by the FAULT parameter of the TEC OPTION function block.

| Module LED Indication | FAULT Parameter Indication | Description |
|---|---|---|
| OFF | SELF TEST | Initialising |
| SHORT FLASH | HARDWARE | Hardware fault |
| FLASH | TYPE MISMATCH | Wrong type or disabled |
| LONG FLASH | PARAMETER | Set-up fault, parameter values out-of-range |
| ON | NONE | Valid set-up, ready for external communications |

## Network LED

This indicates the state of the connected network.

| Network LED Indication | Description |
|---|---|
| OFF | NOT READY/DISABLED: Initialising. |
| SHORT FLASH | IDLE: No data is being received from Network Control Module. |
| FLASH | SOFT TIMEOUT: Drive not addressed in the last 10 seconds. |
| ON | OK: Device has been addressed. |

***Note:*** *The NETWORK LED can only be in the ON state when the MODULE LED is ON continuously, indicating that the Option is ready for external communications.*

# 8
# Initial Set-up for Johnson Controls N2

## Configuring the Drive

**MMI Menu Map**
*Non-specific MMI view*

1 SETUP
2 COMMUNICATIONS
3 TEC OPTION
- TYPE
- INPUT 1
- INPUT 2
- INPUT 3
- INPUT 4
- INPUT 5
- FAULT
- VERSION
- OUTPUT 1
- OUTPUT 2

Using the Operator Station (MMI) or other suitable PC programming tool, the TEC OPTION function block requires configuring before the Metasys N2 option can be used.

The parameter names/functions in the TEC OPTION function block are inter-dependant and will change with different parameter values and the various Technology Options that can be fitted.

The top function block diagram shows the ConfigEd Lite parameter names, which are also displayed on the MMI if no Technology Option is fitted or an incorrect TYPE is selected for the fitted Technology Option.

*ConfigEd Lite is Eurotherm Drives' Windows-based block programming software.*

When the TYPE parameter is set to display RS485, the function block parameters take on new identities, as shown in the lower Function Block diagram.

### Selecting Johnson Controls N2

(Select Advanced view level on the Operator Station and view the TEC OPTION function block).

- Select RS485 in the TYPE parameter
- Select Metasys N2 in the PROTOCOL parameter
- Select Node Address 1 - 255
- Check the FAULT parameter for error messages and rectify if necessary

When setting values for parameters from ConfigEd Lite (or other suitable PC programming tool) you are able to select any value in the parameter's range, i.e. -32768 to 32767. If the value is incorrect, i.e. it doesn't correspond to a value that can be set using the MMI, then the FAULT output parameter will be set to PARAMETER.

**MMI Menu Map**
*Metasys N2 MMI view*

1 SETUP
2 COMMUNICATIONS
3 TEC OPTION
- TYPE
- PROTOCOL
- ADDRESS
- UNUSED 1
- UNUSED 2
- UNUSED 3
- FAULT
- VERSION
- NETWORK STATE
- UNUSED 5

## MMI Parameter Descriptions for Metasys N2

**TYPE** *Range: Enumerated - see below*

Selects the type of Technology Option. The TYPE parameter is automatically set when defaults are loaded if a Technology Option is present.

*Enumerated Value : Type*

0 : NONE
1 : RS485
2 : PROFIBUS DP
3 : LINK
4 : DEVICENET
5 : CANOPEN
6 : LONWORKS
7 : CONTROLNET
8 : MODBUS PLUS
9 : ETHERNET

**PROTOCOL** *Range: Enumerated - see below*

Select to use the METASYS N2 protocol.

*Enumerated Value : Protocol*

0 : EI ASCII
1 : EI BINARY
2 : MODBUS RTU
3 : P1 FLN
4 : METASYS N2

**ADDRESS** *Range: 1 > 255*

Selects the Node address of this drive

**FAULT** *Range: FALSE/TRUE*

The fault state of the Technology Option.

*Enumerated Value : Fault*

| | |
|---|---|
| 0 : NONE | no faults |
| 1 : PARAMETER | parameter out-of-range |
| 2 : TYPE MISMATCH | TYPE parameter not set to RS485 |
| 3 : SELF TEST | hardware fault - internal |
| 4 : HARDWARE | hardware fault - external |
| 5 : MISSING | no option fitted |

Also refer to Module LED, page 6.

**VERSION** *Range: 0000 to FFFF*

The version of the Technology Option card. For example, 0101 is version 1.1. If no option is fitted then the version is reset to 0000. Also refer to Network LED, page 7.

**NETWORK STATE** *Range: Enumerated - see below*

Shows the current Network State of the Technology Option card.

*Enumerated Value : Network State*

| | |
|---|---|
| 0 : OK | network comms to this device |
| 1 : SOFT TIMEOUT | no comms addressed to this device during last 10 seconds. |
| 2 : ACTIVITY | activity on the Serial Port but not to the device |
| 3 : IDLE | no comms on Serial Port |
| 4 : NOT READY | device not yet initialised for communication |
| 5 : DISABLED | Serial communication has been disabled (default) |

Also refer to Network LED on page 7.

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# Troubleshooting

| LED Indications | | Cause/Symptom | Remedy |
|---|---|---|---|
| NETWORK | MODULE | | |
| (OFF) | | No power at the drive. | Check and apply power to the drive. |
| | | Technology Box/Option not installed correctly. | Check connections between Technology Box/Option and drive. On the HVAC10 Size 1, check the ribbon cable. |
| | | Hardware fault.<br><br>**HVAC10 Size 1 WARNING**: Remove the terminal cover and the Technology Box whilst connected to see the drive's HEALTH and RUN LEDs.<br>**BEWARE OF ELECTRIC SHOCK.** | If HEALTH and RUN LEDS are OFF, replace the drive, else replace the Technology Box/Option. |
| | | The self-test has failed. | Replace the Technology Box/Option. |
| | | Incorrect Technology Box/Option fitted or selected. | Fit the correct Technology Box/Option or select the matching value for the TYPE parameter in the TEC OPTION function block. (TYPE = RS485). |
| | | Set-up fault. A TEC OPTION parameter is out-of-range. | Select the correct value for the parameter in the TEC OPTION function block. |
| | | NOT READY/DISABLED: Initialising. | If this condition persists for longer than 10 seconds check wiring to RXA and RXB terminals. It may be transposed. |
| | | IDLE:<br>No data is being received from Network Control Module. | Enable the Network Control Module application program.<br><br>Check that switch SW1:1 is ON, i.e. selected for 2-wire operation.<br><br>Check power for all equipment on the network, e.g. RS232 to RS485 converter or repeater. |
| | | SOFT TIMEOUT:<br>Drive not addressed in the last 10 seconds. | Check the Network Control Module program is running. |
| | | OK | |

# Metasys Point List

*Point Types*

| | | | |
|---|---|---|---|
| AI | Analog Input | IF | Internal Float |
| BI | Binary Input | II | Internal Integer |
| AO | Analog Output | IB | Internal Byte |
| BO | Binary Output | | |

| NPT | NPA | Units | Point Description | Range/Value | Mapping (Tag #) | Decimal Place |
|---|---|---|---|---|---|---|
| AI | 1 | Hz | Freq Output | 0 to 240 | 591 | 2 |
| AI | 2 | Hz | Freq Demand | 0 to 240 | 255 | 2 |
| AI | 3 | RPM | Speed | 0 to 5000 | 569 | 0 |
| AI | 4 | A | Current | 0 to 2000 | 67 | 1 |
| AI | 5 | % | Torque | 0 to 150 | 70 | 2 |
| AI | 6 | kW | Power | 0 to 500 | - | 1 |
| AI | 7 | kWh | Drive kWh | 0 to 65535 | - | 1 |
| AI | 8 | Hrs | Runtime | o to 65535 | - | 0 |
| AI | 9 | Volts | DC Bus Volts | 0 to 1000 | 75 | 0 |
| AI | 10 | Volts | Output Volts | 0 to 1000 | 1020 | 0 |
| AI | 11 | % | Analog In 1 | -100 to 100 | 16 | 2 |
| AI | 12 | % | Analog In 2 | -100 to 100 | 25 | 2 |
| AI | 13 | % | Analog In 3 | -100 to 100 | 715 | 2 |
| AI | 14 | % | Analog In 4 | -100 to 100 | 722 | 2 |
| AI | 15 | % | PID Feedback | -100 to 100 | 764 | 2 |
| AI | 16 | % | PID output | -100 to 100 | 320 | 2 |
| AI | 17 | - | Error Status | 0 to 65535 | - | 0 |
| | | | | | | |
| BI | 1 | - | Direction | 0 = FWD, 1 = REV | 256 | - |
| BI | 2 | - | RUN | 0 = FWD, 1 = REV | 285 | - |
| BI | 3 | - | O/P Relay 1 | 0 = OFF, 1 = ON | 52 | - |
| BI | 4 | - | O/P Relay 1 | 0 = OFF, 1 = ON | 55 | - |
| BI | 5 | - | O/P Relay 3 | 0 = OFF, 1 = ON | 737 | - |
| BI | 6 | - | Flycatching | 0 = FALSE, 1 = TRUE | 576 | - |
| BI | 7 | - | Purge | 0 = NORMAL, 1 = PURGE | 142 | - |
| BI | 8 | - | Tripped | 0 = FALSE, 1 = TRUE | 289 | - |
| BI | 9 | - | Auto Mode | 0 = MANUAL, 1 = AUTO | 297 | - |
| | | | | | | |
| AO | 1 | | Stop Mode | 0 to 2 | 279 | 0 |
| AO | 2 | PCT | Curr Limit | 0 to 150 | 365 | 2 |
| AO | 3 | SECS | Accel Time 1 | 0 to 3000 | 258 | 1 |
| AO | 4 | SECS | Decel Time 1 | 0 to 3000 | 259 | 1 |
| AO | 5 | SECS | Stop Decel T | 0 to 600 | 263 | 1 |
| AO | 6 | SECS | Fast Decel T | 0 to 30 | 264 | 1 |
| AO | 7 | % | Reference SP | -300.0 to 300.0 | 269 | 2 |

# Metasys Point List cont.

*Point Types*

| | | | |
|---|---|---|---|
| AI | Analog Input | IF | Internal Float |
| BI | Binary Input | II | Internal Integer |
| AO | Analog Output | IB | Internal Byte |
| BO | Binary Output | | |

| NPT | NPA | Units | Point Description | Range/Value | Mapping (Tag #) | Decimal Place |
|---|---|---|---|---|---|---|
| AO | 8 | - | S/W Speed SP | 0 to 4 | 151 | 2 |
| AO | 9 | PCT | PID Ref | -300 to 300 | 310 | 2 |
| AO | 10 | PCT | Preset Spd 1 | -300 to 300 | 349 | 2 |
| AO | 11 | PCT | Preset Spd 2 | -300 to 300 | 348 | 2 |
| AO | 12 | PCT | Preset Spd 3 | -300 to 300 | 350 | 2 |
| AO | 13 | % | Analog 1 Out | -300.00 to 300.00 | 45 | 2 |
| AO | 14 | % | Analog 2 Out | -300.00 to 300.00 | 731 | 2 |
| AO | 15 | % | Analog 3 Out | -300.00 to 300.00 | 800 | 2 |
| AO | 16 | Hz | Skip Freq 1 | 0 to 480 | 342 | 1 |
| AO | 17 | Hz | Band 1 | 0 to 480 | 341 | 1 |
| AO | 18 | Hz | Skip Freq 2 | 0 to 480 | 343 | 1 |
| AO | 19 | Hz | Band 2 | 0 to 480 | 680 | 1 |
| AO | 20 | Hz | Skip Freq 3 | 0 to 480 | 344 | 1 |
| AO | 21 | Hz | Band 3 | 0 to 480 | 681 | 1 |
| AO | 22 | Hz | Skip Freq 4 | 0 to 480 | 345 | 1 |
| AO | 23 | Hz | Band 4 | 0 to 480 | 682 | 1 |
| AO | 24 | | AR attempts | 1 to 10 | 612 | 0 |
| AO | 25 | SECS | AR Delay | 0 to 600 | 613 | 1 |
| | | | | | | |
| BO | 1 | | Direction SP | 0 = FWD, 1 = REV | 39 | - |
| BO | 2 | | RUN SP | 0 = FWD, 1 = REV | 271 | - |
| BO | 3 | | Coast Stop | 0 = FALSE, 1 = TRUE | 271 | - |
| BO | 4 | | Fast Stop | 0 = FALSE, 1 = TRUE | 271 | - |
| BO | 5 | | Run Enable | 0 = DISABLE, 1 = ENABLE | 271 | - |
| BO | 6 | | Flycatch EN | 0 = FALSE, 1 = TRUE | 570 | - |
| BO | 7 | | S/W Spd Sel | 0 = H/W, 1 = S/W | 152 | - |
| BO | 8 | | Preset Sel | 0 = MAIN, 1 = PRESET | 355 | - |
| BO | 9 | | Reset Fault | 0 = OK, 1 = RESET | 271 | - |
| BO | 10 | | AR Enable | 0 = FALSE, 1 = TRUE | 611 | - |

| ISS. | MODIFICATION | ECN No. | DATE | DRAWN | CHK'D |
|---|---|---|---|---|---|
| 1 | First release of HA470901. | 16656 | 16/04/03 | CM | DL |

FIRST USED ON

MODIFICATION RECORD

Johnson Controls Metasys N2
Communications Interface

EUROTHERM DRIVES

DRAWING NUMBER

ZZ470901

SHT. 1

OF 1