

# **MSC-3**

# **COMMUNICATIONS**

## **BACnet Protocol**

**Version 2**



## **ZENER TECHNOLOGY AND QUALITY ASSURANCE**

Since 1976 Zener Electric has supplied many thousands of drives to industry. These drives have been installed into numerous applications resulting in a wealth of in house experience. The Zener MSC-3 AC variable speed controller is the culmination of this experience, modern technology and industrial application requirements. The Zener Quality Assurance program ensures that every MSC-3 manufactured has proven to operate correctly in the production test bay before dispatch.

## **SAFETY**

Your MSC-3 must be applied, installed and operated in a safe manner. It is the responsibility of the user to ensure compliance with all regulations and practices covering the installation and wiring of your MSC-3. The instruction manual should be completely read and understood before attempting to connect or operate the MSC-3. Only skilled personnel should install this equipment.

This equipment contains a number of components that are designated by their various manufacturers as "not for use in life support appliances, devices or systems where malfunction of the components can reasonably be expected to result in personal injury or death". Customers using or selling Zener products for use in such applications do so at their own risk and agree to indemnify Zener for any damage resulting from improper use or sale.

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## Explanation of symbols



WARNING

Indicates a condition or practice that, if the warning is not strictly observed, could result in personal injury or death.



CAUTION

Indicates a condition or practice, if the caution is not strictly observed, could lead to damage or destruction of equipment or a significant impairment of proper operation.



WARNING

This symbol is used to highlight an electrical hazard. Failure to strictly observe the warning could result in electrocution.



This symbol is used to highlight additional information on the product's capabilities or a common error in installation, commissioning or operation.

## Warnings



Read all operating instructions before installing, wiring, operating, servicing or inspecting the MSC-3.

Ensure that the instruction manual is made available to the final user of the product as well as all personnel involved in any aspect of installation, adjustment or maintenance.

Your MSC-3 must be applied and installed by a suitably qualified and experienced electrical tradesperson in accordance with this manual, good engineering practice and all local rules and regulations



There are hazardous voltages inside the MSC-3 whenever it is connected to an electrical supply and for some time afterwards.

Before touching anything inside the MSC-3 enclosure or other equipment connected to the MSC-3 terminals, disconnect all sources of electrical power, wait at least 11 minutes for capacitors within the MSC-3 to discharge to less than 50VDC and then ensure, by measurement, that there is no hazardous AC or DC voltage present at any terminal.

The MSC-3 contains high energy circuits that may be hazardous. Do not operate the MSC-3 with the door open or any part of the enclosure removed.

Do not touch the terminals of the MSC-3 or any associated motor and wiring when it is energised, even if the MSC-3 and motor are stopped. Electric shock may result.

Do not modify this equipment electrically, mechanically or otherwise. Modification may create safety hazards as well as voiding the UL listing of models so listed.

The MSC-3 is designed to drive an appropriately rated and otherwise suitable 3 phase induction motor. It is not suitable for single phase motors or other types of motor or non-motor load. Use with inappropriate load types may create a safety hazard.

Where the MSC-3 is used as a component part of another product, it is the purchaser's responsibility to ensure that the final product meets all of the necessary safety, EMC, regulatory, operational and other requirements for that product. Requirements for the purchaser's final product may be substantially different to the requirements for stand-alone inverters.

The MSC-3 is intended for use only in fixed wiring applications. It is not intended for use on a flexible supply cable.



The MSC-3 contains a substantial EMC line filter and as a result it is unsuitable for use on earth leakage protected circuits.

Mount the MSC-3 on a vertical, incombustible surface such as metal or masonry. Do not place combustible or flammable material near the MSC-3. Failure to observe these precautions may create a fire hazard.

The MSC-3 is manufactured under strict quality control arrangements, however additional and independent safety equipment must be installed if the application is such that failure of the product may result in personal injury or property damage.

Ensure that electrical noise generated by the product and any associated equipment does not adversely affect the proper operation of other equipment or systems, particularly those that have a safety function.

Install emergency stop circuitry that removes power from the MSC-3 and does not depend on any feature of the product for proper and safe operation. Do not use the braking functions of the product for safety purposes.

The MSC-3 has features that may be used to cause an automatic restart in certain circumstances. The overall application (machine etc) must be designed such that automatic restart is not hazardous.

Do not install this equipment in locations where mechanical damage to the enclosure is possible. In particular, consider vehicles, vandalism and attack by insects or animals. Severe equipment damage and safety hazards may result.

## Receiving

Inspect the MSC-3 for any shipping damage. If any damage is found, report it to the carrier immediately. Access the inside of the controller and visually check for any damage.

Do not attempt to operate the MSC-3 if any obvious damage exists.

After the initial inspection, the MSC-3 can be repacked and stored in a clean, dry location until it is required for use.

DO NOT store this equipment in an area where the ambient temperature will fall below -20°C (-4°F) or rise above 70°C (158°F). DO NOT store this equipment in areas that are subject to condensation or corrosive atmosphere. Proper storage is necessary to ensure satisfactory controller start up and performance.

## Introduction

This manual describes the installation, features and operations of the **MSC-3** BACnet protocol communication option. The features of this option include:

The MSC-3 BACnet interface implements the standard Application Specific Controller (B-ASC) as described in ASHRAE Standard 135 2004.

### BACnet Services Supported

- Who-Is
- I-Am
- Who-Has
- I-Have
- Read Property
- Write Property

### Data Link Layer

The MSC-3 implements the BACnet MS/TP Data Link Layer as a master device. The communications port is RS-485 compliant and fully isolated from ground and other circuits.

### Baud Rate Selection

All standard MS/TP baud rates (9600, 19200, 38400 and 76800) are supported. Baud rate selection is via the front panel.

### MAC ID

Set via the front panel

### Device Object Instance

Set via the front panel. Defaults to be the same as the MAC ID, however it may be set independently.

### Compatibility

This manual describes the features of the BACnet Protocol communications option hardware assembly B126012 with software version 1.03 and is compatible with MSC-3 Control Board Software version 1.57.4 or later. Also compatible with FS2 software version 4.0.13.x.

Please note that BACnet Protocol communications option units using hardware assembly B119961 (produced prior to November 2011) are described in manual IM00115. These earlier units are easily identified by the fact that they do **not** mount behind the MSC-3 control board.





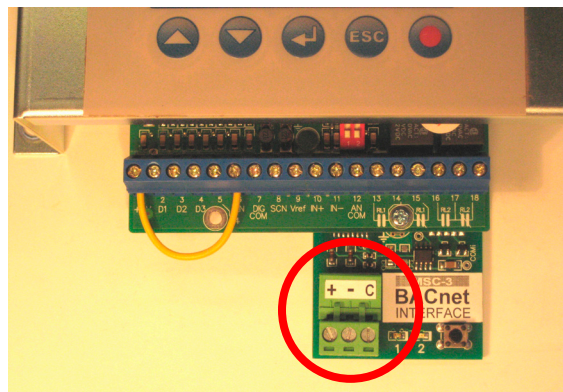
## Installation - Wiring

Careful attention to industry standard wiring practices for RS-485 installations will reduce the risk of electrical noise issues with the communications wiring.

These precautions include:

- Use twisted pair shielded communications cable.
- It is recommended that the circuit commons be connected in addition to communication conductors.
- Each length of cable should have its shield connected to ground at one end only (earthing recommended at the computer / controller end). The shield connection should be made as close as possible to the earthing conductor.
- Avoid laying communication cables adjacent to power cabling and wiring. If not possible utilise the best separation of communication cabling and power cabling.
- If possible communication cables should cross power cables at right angles to each other.

## BACnet Terminal Locations



## BACnet MS/TP Network Wiring

The BACnet standard (ANSI/ASHRAE 135-2008) requires the use of shielded, twisted pair cable for MS/TP EIA-485 networks. Foil or braided shields are acceptable.

The polarity of the connection is important. All 3 terminals “+”, “-” and “C” (common) should each connect to similarly marked terminals at each BACnet node. This wiring must follow a “daisy chain” layout. “T” connections are not permitted. The cable screen should be ungrounded and continuous through each node, with a single ground connection at one end of the segment only. A maximum of 32 nodes may be connected to each MS/TP segment. Additional nodes may be accommodated by the use of repeaters. A termination resistors of 120 Ohms are required at each end of the MS/TP segment and are prohibited elsewhere.

See the BACnet standard (ANSI/ASHRAE 135-2008) and EIA-485 for further details of wiring requirements. The MSC-3 BACnet interface will function if the shield is employed as network common.

## Inverter Output Wiring

Improperly installed inverter output wiring (inverter to motor cable) has the potential to cause interference to other circuits including EIA-485 communications as used on BACnet MS/TP networks. To avoid interference issues, ensure that all inverters in the installation, irrespective of their association with the BACnet network or not, are properly installed according to the *Installation Practices for Electromagnetic Compatibility (EMC) compliance* section of the *MSC-3 Instruction Manual IM00092B* (begins on page 11).



### Communications Setup

Communication setup must be completed or at least checked before communications can begin. For the MSC3 the K00 COMMS SETUP menu is where alterations to the setup may be made.

#### K00 Comms Setup

Menu Location: First menu

Choices:

- K01 Protocol
- K02 MAC ID
- K48 Device Object Instance (H)
- K49 Device Object Instance (L)
- K50 Max Master
- K51 Serial No.
- K47 Terminal Run

#### K01 Protocol

Menu Location: K00 Communications

Choices:

- MS/TP 9600 (initial setting)
- MS/TP 19200
- MS/TP 38400
- MS/TP 76800

Use the up and down push buttons to move through the list, press Enter to accept the displayed setting or Esc to abort the selection of a protocol.

#### K02 MAC ID

Menu Location: K00 Communications

Range: 1 (initial setting) to 254

Each BACnet device on an MS/TP network requires a unique drive MAC ID. The MAC ID is used to identify the drive on the communication network. Use the up & down push buttons to alter the ID, press Enter to accept or Escape to abort.

#### K48 Device Object Instance (H)

#### K49 Device Object Instance (L)

Menu Location: K00 Communications

Range: 0 (initial setting) to 4194

Range: 0 (initial setting) to 999

(Overall range 0 to 4,194,302)

This parameter allows the Device Object Instance to be set to any desired value up to 4194302. Enter the least significant 3 digits into K49 and the remaining digits into K48. The Device instance that the BACnet interface will use is  $K49 \times 1000 + K48$ . To use the MAC ID value as the Device Object Instance, set the Device Object Instance (both numbers) to zero.

#### K50 Max Master

Menu Location: K00 Communications

Range: 1 to 127 (initial setting)

This setting specifies the Device Object Max Master property of the BACnet interface.

Use the up or down push buttons to change the Max Master, press Enter to accept the displayed setting or Esc to abort the change.

## K51 Serial No.

Entry of the drive's serial No. is useful for network device identification from the BACnet network perspective.

Locate the drive's serial No. and enter it through the "K51 Serial No." displayed on the top line of the console display, press Enter to reveal the existing setting. Press the "Up" and "Down" push buttons to select a different character and press Enter to accept that character and move to the next character on the display. Repeat several more times until the serial is entered.

## K47 Terminal Run

Menu Location: K00 COMMS SETUP

Choices: K23 ENABLE (Default)

K24 DISABLE

This selection determines the source of the run signals. When enabled, the run signals are sourced from a terminal strip. When disabled the run signals are sourced from the BACnet network. This selection gives system designers the assurance of knowing which run signals will be obeyed.

## Fault Log

The fault log will record the date, time and drive status when a fault or trip occurs. The last 10 faults are recorded. A fault mask is provided to filter out power fail and under volt trips to avoid filling the log with power down trips.

### K04 Fault Log

Menu Location: First menu

Choices: K05 View Log

K06 PF/Uv Mask

K07 Clear Log

### K05 View Log

Menu Location: K04 Fault Log

Display format: top line FF: XXXXXXXXXX  
bottom line yyyyMMMdd hh:mm

Where:

FF	is the fault where 1 is the latest fault and 10 is the oldest.
XXXXXXXXXX	fault status code (a '1' indicates the corresponding fault). The digits are read left to right and the corresponding trip is read top to bottom
1	Thermistor over temperature
2	I2t trip
3	Over temperature
4	Supply Fail
5	Power Fail
6	DC Low
7	Over current
8	Over Voltage
9	Output Short Circuit
yyyyMMMdd	is the date of the fault
hh:mm	is the time of the fault

Use the up and down push buttons to move through the log. Press Enter (↵) or Escape (ESC) to finish viewing the log. To facilitate correct logging, check for correct date and time. See menu K16 DATE/TIME for details.



### K06 PF/UV Mask

Menu Location: K04 Fault Log

Choices:        K23 Enabled  
                  K24 Disabled (initial setting)

The K06 PF/UV Mask when enabled prevents a power fail or under volts trip from making an entry in the fault log. This may be useful in those applications where the power is cycled on and off regularly. Use the up and down push buttons to select enable or disable, press Enter (↵) to accept the displayed setting or Escape (ESC) to abort the change.

### K07 Clear Log

Menu Location: K04 Fault Log

This is a two-step sequence to clear the fault log. Press Enter (↵) once and “**K25 continue ?**” is displayed. Press Enter (↵) a second time to clear the fault log or press Escape (ESC) to abort.

## Run Log

The run log records motor and drive run time information, such as hours run and kilowatt-hours.

### K08 Run Log

Menu Location: First menu

Choices:        K09 Hours run  
                  K10 kWh  
                  K11 Clear Log

### K09 Hours Run

Menu Location: K08 Run log

Initial value:    0

The number of hours the motor has been running for is recorded in the run log. If the drive is on and the motor has not been running as indicated by the O00 RUN relay output, no time is recorded. Press Escape (ESC) to return to the menu. The Hours Run reading is available as a run variable. See the section “Available Run Variables” for details

### K10 kWh

Menu Location: K08 Run log

Initial value:    0

The kWh log records the energy used by the motor. Press Escape (ESC) to return to the menu. The kWh reading is available as a run variable. See the section “Available Run Variables” for details.

### K11 Clear Log

Menu Location: K08 Run log

This is a two-step sequence to clear the run log. Press Enter (↵) once and “**K25 continue ?**” is displayed. Press Enter (↵) a second time to clear the run log or press Escape (ESC) to abort.

## Essential Services Override Log

Supplementary ESO information is recorded by the MSC-3. The date and time of ESO feature activation is recorded as well as the date and time of drive stress (operated beyond design specifications) in ESO mode. Reset of the activation and stressed date and time is security code protected.

### K12 ESO log

Menu Location: First menu

Choices: K13 ESO activated  
K14 ESO stressed  
K15 Clear log

### K13 ESO activated

Menu Location: K12 ESO log

Display format: top line K13 ESO activated  
bottom line yyyyMMMdd hh:mm

Where:

yyyyMMMdd is the date of activation  
hh:mm is the time of activation

This menu displays the date and time of the last activation of the ESO feature. Activation is detected when the MSC-3 enters ESO mode operation. Press Escape (ESC) to return to the menu.

### K14 ESO stressed

Menu Location: K12 ESO log

Display format: top line K13 ESO stressed  
bottom line yyyyMMMdd hh:mm

Where:

yyyyMMMdd is the date when the MSC-3 was stressed  
hh:mm is the time when the MSC-3 was stressed

In ESO mode the MSC-3 will ignore any of the following trips: SUPPLY F, I2T TRIP, OT and OT THERM. When this occurs, the MSC-3 and motor is operated beyond design specifications. The date and time of the last occurrence of this event is recorded in the K14 ESO stressed menu. Press Escape (ESC) to return to the menu.

### K15 Clear log

Menu Location: K12 ESO log

The ESO log is protectively coded against accidental clearing. Press Enter (↵) and MSC-3 waits for the protective code 1472 to be entered. Use the Up (▲) and Down (▼) push buttons to set the code and press Enter (↵) to accept the code and if correct it will clear the ESO log.

## Time Keeping

There are several features that require a date and time. To support these features time keeping needs to be set with the correct time. Date and time adjustments are done in the K16 Date/Time menu. Press Enter (↵) to begin time adjustment.

### K16 Date/Time

Menu Location: First menu



### K17 Year

Menu Location: K16 Date/Time

Initial value: 2000

Range: 2000...2099

Use the up and down push buttons to adjust the year. Press Enter (↵) to accept the setting or Escape (ESC) to abort. Pressing Escape (ESC) will abort the adjustment and proceed to the month setting.

### K18 Month

Menu Location: K16 Date/Time

Choices:	JAN (initial value)	MAY	SEP
	FEB	JUN	OCT
	MAR	JUL	NOV
	APR	AUG	DEC

Use the up and down push buttons to change the month. Press Enter (↵) to accept the setting or Escape (ESC) to abort. Pressing Escape (ESC) will abort the adjustment and proceed to the day adjustment

### K19 Day

Menu Location: K16 Date/Time

Initial value: 1

Range: 1...31

Use the up and down push buttons to adjust the day of the month. Press Enter (↵) to accept the setting or Escape (ESC) to abort. Pressing Escape (ESC) will abort the adjustment and proceed to the hour setting.

### K20 Hours

Menu Location: K16 Date/Time

Initial value: 0

Range: 0...23

Use the up and down push buttons to adjust the hour. Press Enter (↵) to accept the setting or Escape (ESC) to abort. Pressing Escape (ESC) will abort the adjustment and proceed to the minute setting.

### K21 Minutes

Menu Location: K16 Date/Time

Initial value: 0

Range: 0...59

Use the up and down push buttons to adjust the minutes. Press Enter (↵) to accept the setting or Escape (ESC) to abort.

## Preset Speed

### K22 Comms Preset

Menu Location: Reference selection list

Range: -100...100 %

The "K22 COMMS PRESET" is an additional speed reference is provided for use with external communications. Use the up and down push buttons to adjust the reference between -100 to 100% of the maximum speed. Press Enter to accept the value or Esc to abort.

Note: Adjustment of the K22 COMMS PRESET through the console will be remembered after the power has been cycled. This is not the case when accessed by communications.



## Objects and Properties Supported

Property	Object Type			
	Device	Binary Value (BV)	Analog Value (AV)	Accumulator (ACC)
Object Identifier	✓	✓	✓	✓
Object Name	✓	✓	✓	✓
Object Type	✓	✓	✓	✓
Description*	✓			
Location*	✓			
System Status	✓			
Vendor Name	✓			
Vendor Identifier	✓			
Model Name	✓			
Firmware Revision	✓			
Application Software Version	✓			
Protocol Version	✓			
Protocol Revision	✓			
Protocol Services Supported	✓			
Protocol Object Types Supported	✓			
Object List	✓			
Max APDU Length Accepted	✓			
Segmentation Supported	✓			
APDU Timeout	✓			
Number APDU Retries	✓			
Max Master	✓			
Maximum Info Frames	✓			
Device Address Binding	✓			
Database Revision	✓			
Present Value		✓	✓	✓
Status Flags		✓	✓	✓
Event State		✓	✓	✓
Out of Service		✓	✓	✓
Units			✓	✓
Priority Array		✓	✓	
Relinquish Default		✓	✓	
Active Text		✓		
Inactive Text		✓		
Max Present Value				✓

\* Device Object Description and Location are R/W.



## Analog Values

Instance ID	Object Name	Description	Units	Present Value Access
AV0	Cpreset	Speed reference	%	C
AV1	Preset	Preset analog value for general use	%	C
AV2	Accel time	Acceleration time 0 – max speed	seconds	C
AV3	Decel time	Deceleration time max speed - 0	seconds	
AV4	S time	S characteristic of acceleration and deceleration	seconds	C
AV5	Current limit	Current limit	Amps	C
AV6	AR allowed	Number of auto restarts allowed	-	C
AV7	AR clear time	Running time without trip to clear auto restart counter	minutes	C
AV8	Under speed	Set point for under speed alarm	%	C
AV9	Over speed	Set point for over speed alarm	%	C
AV10	Speed	Motor speed	RPM	R
AV11	Speed	Motor speed	%	R
AV12	Frequency	VFD output frequency	Hz	R
AV13	Load	Load torque	%	R
AV14	Current	Motor phase current	Amp	R
AV15	DC Volts	DC bus voltage	Volt	R
AV16	Power	Power to motor	kW	R
AV17	AC Volts	Inverter output voltage	Volt	R
AV18	Temp	Heatsink temperature	Degree C	R
AV19	I2T used	Amount of the thermal capacity of the motor used	%	R

## Accumulators

Instance ID	Object Name	Description	Units	Present Value Access
ACC0	kWh	kWh consumed by the motor	kWh	R
ACC1	Hours Run	Number of motor operation hours	hours	R

Present Value Access:

R = Read only

W = Writeable

C= Commandable

Commandable objects support priority arrays and relinquish defaults.



## Binary Values

Instance ID	Object Name	Description	Active Text	Inactive Text	Present Value Access
BV0	Run fwd	Run FWD Command	Active	Inactive	C
BV1	Run rev	Run REV Command	Active	Inactive	C
BV2	Reset	Reset Command	RESETTING	Inactive	W
BV3	ESO	ESO Mode	ESO ACTIVE	Inactive	C
BV4	Remote	Remote Status	Remote	Local	R
BV5	Enabled	Enable Status	Enabled	Disabled	R
BV6	Switching	Switching Status	Switching	Output Off	R
BV7	Powered up	Power Up Status	Powered Up	Warming Up	R
BV8	Buscharged	Bus Charged Status	Bus Charged	Charging	R
BV9	Ramping to stop	Ramping Status	Ramping to Stop	Clear	R
BV10	Coasting	Coasting Status	Coasting	Clear	R
BV11	ARfailed	Auto Restart Status	AUTO RESTART FAILED	Ready	R
BV12	OPTSC	Output Short Status	OUTPUT SHORT	Clear	R
BV13	Overvoltage	Over Voltage Trip	OVERVOLTAGE	Clear	R
BV14	Overcurrent	Over Current Trip	OVERCURRENT	Clear	R
BV15	DC low	DC Low Trip	DC LOW	Clear	R
BV16	Power fail	Power Fail Trip	POWER FAIL	Clear	R
BV17	Over temp	Over Temp Trip	OVER TEMPERATURE	Clear	R
BV18	I2t trip	I2tTrip	I2t TRIP	Clear	R
BV19	Tripped	Trip Status	TRIPPED	Clear	R
BV20	Vlimit	Voltage Limit	Active	Inactive	R
BV21	Climit	Current Limit	Active	Inactive	R
BV22	Zero speed	At Zero Speed	Zero Speed	Turning	R
BV23	At speed	At Speed Status	At commanded speed	Speed Changing	R
BV24	Run	Run Status	Running	Stopped	R

Present Value Access:

R = Read only

W = Writeable

C= Commandable

Commandable objects support priority arrays and relinquish defaults.

## BACnet setup and operation

Setting up the MSC-3 for various applications with BACnet communications is similar to conventional wired control using the terminal strip. Please refer to the MSC-3 Instruction Manual IM00092B for full details of setup and operation of the MSC-3. The interactions between the standard (wired) control features and BACnet features is as follows:

### Local mode

Control of the run function (ie starting and stopping) is from the console. BACnet commands do not influence the starting and stopping of the MSC-3 in local mode.

The speed reference used for local operation is determined by the reference source selected by parameter F02 LOCAL. Available choices include the console (R07 CONSOLE REF) and the BACnet object Cpreset (K22 COMMS PRESET).

### Remote mode

Control of the run function (ie starting and stopping) is either from the terminal strip or by BACnet depending on the setting of K47 TERMINAL RUN. Setting this parameter to ENABLE allows the terminal strip alone to control the run function. Selecting DISABLE allows BACnet alone to control the run function via binary value objects "Run fwd" and "Run rev"

### Reset

Reset commands from all sources (terminal strip, internal MSC-3 functions and BACnet) are honoured at all times.

### Essential services operation (ESO)

ESO mode selection from all sources (wired terminal or BACnet binary object ESO) is honoured at all times.

### Local / remote mode selection

Control of local/remote mode is always from the terminal strip. In the local mode, stopping and starting is controlled from the console. In remote mode, selection of the source of stopping and starting commands from the terminal strip or the BACnet interface is determined by the setting of K47 Terminal Run. Starting and stopping commands in remote mode are taken from the terminal strip when K47 Terminal run is enabled and from the BACnet interface when K47 is set to disabled.

The BACnet speed reference is available in both local and remote modes as K22 COMMS PRESET. The selection of a reference source for each mode can be set via the F00 REFERENCES menu item.

### Monitoring

Operation of the MSC-3 may be monitored via BACnet regardless of the local/ remote mode.

## **BACnet installation – Quick guide**

1. Check that the BACnet option card is installed in the MSC-3. The ribbon cable should go to the right hand option board socket on the back of the control board.
2. Set up all the usual menu items according to the application needs. There are a number of quick setup guides for the common HVAC applications in the MSC-3 Instruction Manual IM00092B that may be of assistance.
3. Set the various BACnet related menu items BEFORE connecting the BACnet wiring. This will avoid disrupting the BACnet network unnecessarily.

### **K01 Protocol**

Select the baud rate\* to suit the BACnet system

### **K02 MAC ID\***

This value must be unique for every BACnet device on the BACnet MS/TP segment (ie the RS-485 circuit) that the MSC-3 is connected to.

### **K48 Device Object instance (H) and K49 Device Object instance (L)**

These two items make up the Device Instance Number\* of the BACnet interface. This is a number between 0 and 4,194,302. The number of each BACnet interface must be unique across the entire BACnet installation.

### **K50 Max Master\***

This is equal to, or greater than the highest MAC ID number on the BACnet MS/TP segment (ie the RS-485 circuit) that the MSC-3 is connected to. For best BACnet MS/TP performance, this should be set as low as possible.

### **K51 Serial No.**

Each BACnet device has a name, which is required to be unique. To ensure that there are no duplicated names, the MSC-3 serial number is used as part of the device object name.

### **K47 Terminal Run**

This parameter determines if run commands are taken from the MSC-3 terminals (K47 = Enabled) or from the BACnet interface (K47 = Disabled).

## **Status LED**

The red LED in the MSC-3 BACnet Interface will flash each time a valid MS/TP token is received. This is a general indication that the interface is participating in a BAC network. At higher baud rates the discrete flashes will merge, giving periods of continuous or intermittent indication, depending on the network traffic.

Note that two or more BACnet MS/TP devices connected together, but disconnected from other parts of the BACnet network will form their own network, creating and passing a token among themselves. The BACnet Standard mandates this behaviour. Take care not to interpret a flashing red LED to mean that the BACnet interface is wired to all the BACnet devices that it should be.

## Troubleshooting Guide

Symptom	Action	Notes
No communications - General	Check that the MAC ID of every device on the MS/TP segment is unique.	Every device connected to an MS/TP segment (ie the RS-485 circuit) must have a unique MAC ID. This parameter is set by menu item K02 MAC ID in the MAC-3. For other devices, see their respective manufacturer's documentation
	Check that the baud rate of all devices on the MS/TP segment is the same.	See MSC-3 menu item K01 Protocol.
	Check the Object Device Number of every device on the BACnet network is unique	See MSC-3 menu items K48 Device Object Instance (H) and K49 Device Object Instance (L).
	Check that K50 MAX MASTER is set to the same value in all MS/TP devices on a particular segment.	This must be equal to, or greater than the highest MAC ID number on the BACnet MS/TP segment (ie the RS-485 circuit) that the MSC-3 is connected to. For best BACnet MS/TP performance, this should be set as low as possible.
	Check that MS/TP wiring polarity is correct	
	Check that end termination resistors are fitted.	See BACnet and RS-485 installation guidelines
	Check that the baud rate elected for the system is compatible with the installed wiring length	See BACnet and RS-485 installation guidelines
Communications only disrupted when a VFD is running	Check that there are no stubs in the M/TP wiring	Stubs and star configuration are not permitted in MS/TP networks. See BACnet installation guidelines
	Check that the VSD motor cable screen is continuous and correctly terminated.	See details in MSC-3 Instruction Manual IM00092B section Installation Practices for Electromagnetic Compatibility (EMC) Compliance (page 11).
	Check segregation between VFD motor wiring and the BACnet network wiring	



BACnet Setup Record

Site: .....

Baudrate (K01): ..... Max Master (K50): .....

Plant designation	Location	MSC-3 model	Serial No. (K51)	MAC ID (K02)	Terminal run (K47) Enabled	BACnet device, instance number (K48, K49)

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