ICP PANEL-TEC MICROGATE

BACNET TO SIEMENS SED2 DRIVE APPLICATION

INSTALLATION AND OPERATION GUIDE

REVISION HISTORY

Revision	Date	Author	Comments
000	19 May 2008	David Walker	Initial release.
001	16 July 2008	David Walker	Added AI4, AI5, BI9 & BI10 Added support for 76,800bps Changed configuration to support 22-bit device instance number

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INTRODUCTION

The BACnet to USS version of the MicroGate connects one SED2 drive to a BACnet MS/TP Network. A pre-defined set of BACnet objects are provided that allow access to the most common drive parameters, monitor values, setpoint values, and control points for the SED2 drive.

Part Numbers

The MicroGate product is sold with several different applications. To ensure that the correct version of the MicroGate is procured, please include the correct part number when ordering. Part numbers for the BACNet to USS MicroGate and the optional power supply are as follows:

Table 1 - Part Numbers

Part Number	Description
5005-201-102	MicroGate BACnet to SED2
4000-0204	MicroGate Power Supply

HARDWARE

Power Supply

The MicroGate requires a regulated 5V DC power source, capable of supplying a minimum of 250mA. Power may be supplied to the MicroGate by either connecting the MicroGate Power Supply to the Input Power jack on the side of the unit, or by providing regulated 5V DC power to pin 9 of the Local serial port.

Programming Switch

The Programming Switch on the MicroGate should always be in the RUN position for normal operations and configuration. The PRG position is used strictly for loading firmware at the factory.

Serial Port Pinouts

The MicroGate comes with two serial ports. The pinouts for the serial ports are shown in the table below.

The Local port is for connection to a local device (in this case, an SED2 Drive), and supports both RS232 and RS485 (2-wire) communications. The Local port is also used for configuration and programming of the MicroGate.

The Network port is for connection to a network (in this case, a BACnet network), and supports RS485 (2-wire) and RS422 (4-wire) communications.

Table 2 - Serial Port Pinouts

Local: DB9-Female		
Pin	**Label**	**Description**
1	485+	RS485 D+
2	TXD	RS232 TxD
3	RXD	RS232 RxD
4	DTR	RS232 DTR
5	GND	Reference Ground
6	485-	RS485 D-
7	RTS	RS232 RTS
8	CTS	RS232 CTS
9	VCC	+5VDC Input

Network: DB9-Male		
Pin	**Label**	**Description**
1	485+	RS485 D+/RS422 RX+
2	485-	RS485 D-/RS422 RX-
3	422+	RS422 TX+
4	422-	RS422 TX-
5	GND	Reference Ground
6	485TERM+	RS485 D+/RS422 RX+ Termination
7	485TERM-	RS485 D-/RS422 RX- Termination
8	422TERM+	RS422 TX+ Termination
9	422TERM-	RS422 TX- Termination

BACNet Network Cable

The user must provide a cable to connect the NETWORK port on the MicroGate to a BACNet network. An example of the connections of such a cable is shown below. Because the BACnet connection type may vary among different installations, no connector type is indicated – the user must specify the correct connector and pinout for this end of the cable.

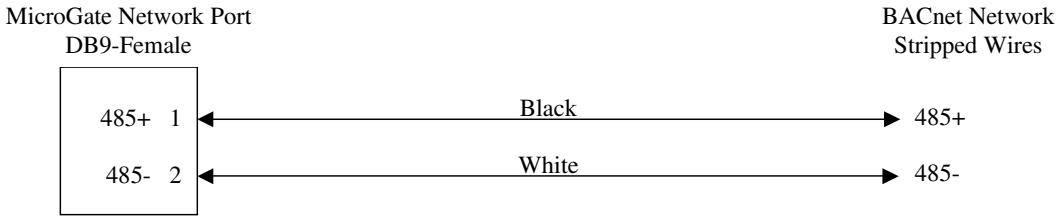

Figure 1 - BACnet Network Cable

USS SED2 Drive Cable

The user must provide a cable to connect the LOCAL port on the MicroGate to the SED2 drive. The cable should end in stripped wires to facilitate connection to the MM40 drive terminals shown in the table below. SED2 drive power should be off while connecting the wires to the drive terminals.

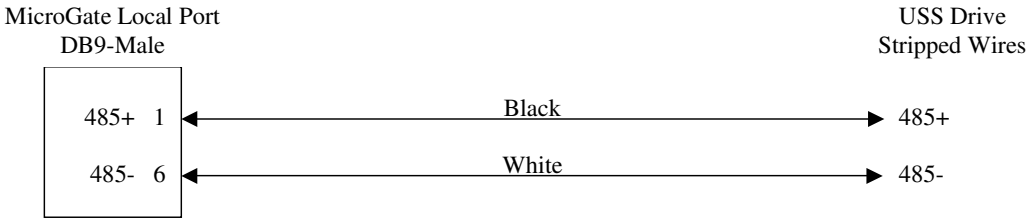

Figure 2 - USS Drive Cable

Table 3 – SED2 Cable Connections

Signal	Connection
485+	SED2 Terminal #29
458-	SED2 Terminal #30

LED Indicators

There are a total of 3 Bi-color LED indicators on the MicroGate. The NET LED displays communications activity on the Network (BACnet) port. The STAT LED displays the overall status of the MicroGate. The LCL LED displays communications activity on the Local (USS-SED2) port. During normal operations, the NET and LCL LEDs will quickly alternate red and green flashes, making it look almost amber. This is normal.

Table 4 – MicroGate General Status LED (STAT)

For this state:	LED is:	To indicate:
No Power	Off	There is no power applied to the device.
Run Mode	Flashing Green (250ms On, 250ms Off)	The MicroGate is operating normally in RUN Mode.
Configuration Mode	Flashing Green (1.5 sec On, 1.5 sec Off)	The MicroGate is in Configuration Mode.
Fatal Error	Flashing Yellow (250ms On, 250ms Off)	The MicroGate has experienced a fatal error, and has halted communications.

Table 5 - Network Communications Activity LED (NET)

For this state:	LED is:	To indicate:
Receive Data	Red	The MicroGate is receiving data from the BACnet Network.
Transmit Data	Green	The MicroGate is transmitting data onto the BACnet Network.

Table 6 – USS-SED2 Communications Activity LED (LCL)

For this state:	LED is:	To indicate:
Receive Data	Red	The MicroGate is receiving data from the SED2 drive.
Transmit Data	Green	The MicroGate is transmitting data to the SED2 drive.

MICROGATE CONFIGURATION

Configuration Cable

The local port on the MicroGate includes RS232 signals for use in configuration, as shown in the pinout and cable diagram below. A standard straight-through DB9-F to DB9-M cable connects the MicroGate to a serial port on a PC during configuration.

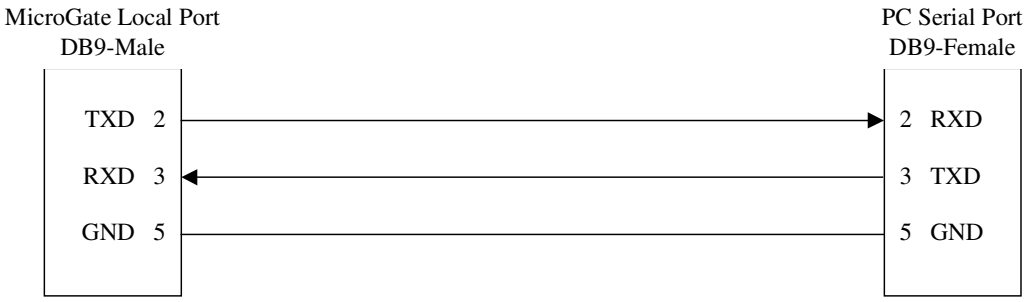

Figure 3 - Configuration Cable

Default Configuration

The BACnet protocol on the Network Port of the MicroGate is configurable to make it easy to add it to an existing BACnet network. The configuration parameters that may be changed are shown in the following table:

Table 7 - Configuration Options

Parameter	Options	Default
Data Link	MS/TP Master MS/TP Slave	MS/TP Master
MAC Address	0-127 (Master) 0-255 (Slave)	10
Device Instance	0-4194303	1
Baud Rate	9600 bps 19200 bps 38400 bps 76800 bps Autobaud	19200 bps

The MicroGate always acts as a Server on the BACnet network. However, the data link layer may be configured as BACnet MS/TP Master (token passing) or BACnet MS/TP Slave (non token passing).

If Autobaud is selected for the Baud Rate, the MicroGate will attempt to detect the baud rate of the network at startup. Once it has detected a valid baud rate to use, it will continue to use that baud rate. If the baud rate of the network changes after a valid baud rate has been detected, the MicroGate will not detect the new baud rate unless it is powered off and back on.

Changing the Configuration

The configuration stored in the MicroGate may be changed from the default configuration by entering Configuration Mode.

1. Attach a configuration cable between the Local port on the MicroGate and a serial port on a PC.
2. Start a terminal program, such as Hyper Terminal, on the PC, and connect using the following settings:
   - Baud = 9600 bps
   - Data bits = 8
   - Parity = None
   - Stop Bits = 1
   - Flow Control = None
3. With the Programming Switch set to "RUN", apply power to the MicroGate, and send a carriage return (press the **Enter** key) within 5 seconds of startup.

Once the MicroGate is in Configuration Mode, it will send its current configuration information to the terminal program, as follows:

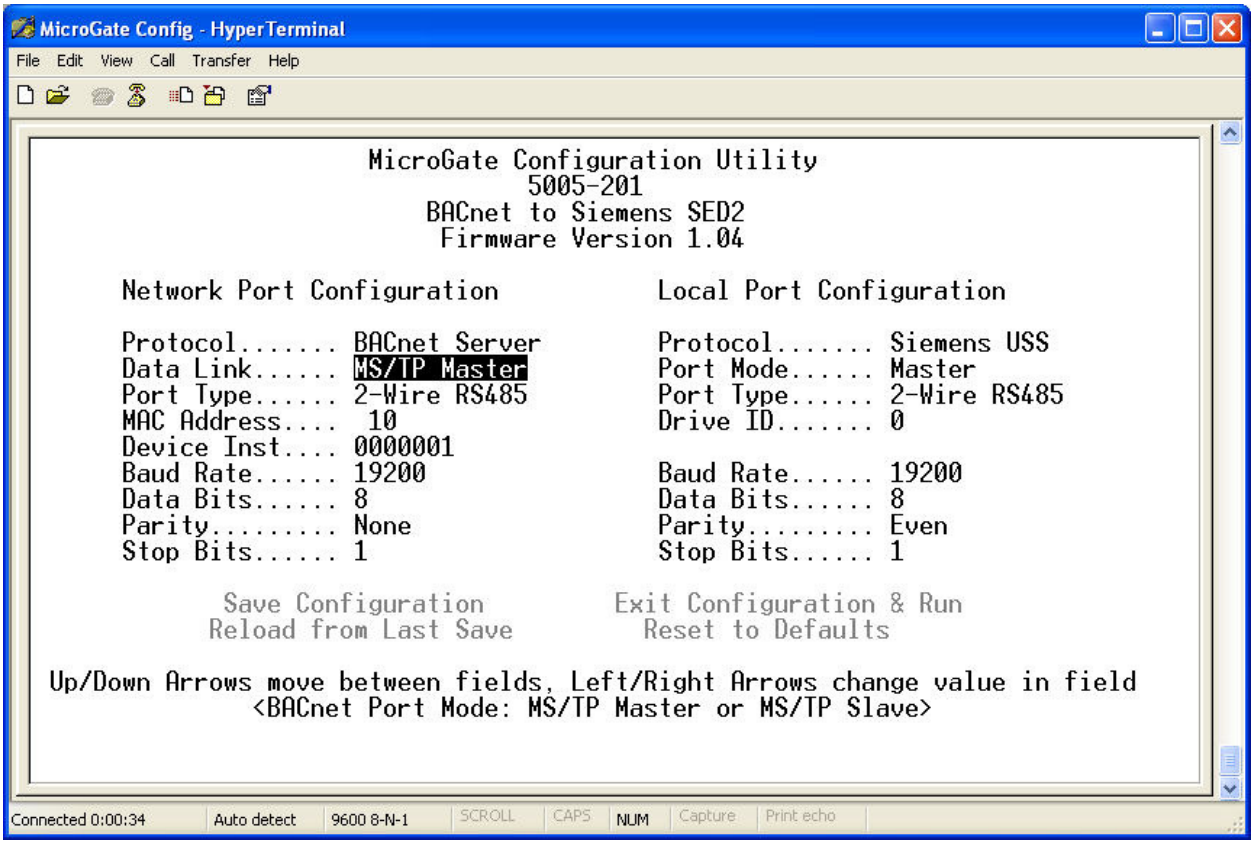

Figure 4 - MicroGate Configuration Display

Use the **up** and **down** arrows on your keyboard to navigate to the field you want to change, then use the **left** and **right** arrows to change the value in that field. When you are finished, navigate to "Save Configuration" and press the **Enter** key to save the configuration information to the MicroGate.

Once the configuration has been saved, remove power from the MicroGate and remove the configuration cable.

SED2 DRIVE SETUP

SED2 Drive Parameter Configuration

The Siemens SED2 drive must be configured before the MicroGate will communicate with the drive. The MicroGate communicates with the SED2 drive using the USS protocol, with the following configuration:

- 19200 baud
- 8 data bits
- even parity
- 1 stop bit
- drive id 0

To setup the SED2 drive for communications with a MicroGate, the drive parameters in the following table must be configured with the values shown via the SED2 keypad.

Table 8 – SED2 Parameter Configuration

SED2 Parameter	Function	Set Value
P0003	User Access Level	3 (Expert Setting)
P0700[0]	Command Source	5 if Starting/Stopping Drive from BACnet Otherwise: **Do Not Change**
P1000[0]	Frequency Setpoint Source	5 if Setting the Frequency from BACnet Otherwise: **Do Not Change**
P2009[0]	USS Normalization	0 (Disabled)
P2010[0]	USS Baud Rate	7 (19.2K baud)
P2011[0]	USS Address	0
P2014[0]	USS telegram off time	0 to Disable the USS "watchdog" timer, or > 0 to enable the USS "watchdog" timer (NOTE: values less than 100ms are not recommended)

Watchdog Timer Setup

The SED2 has a timeout function for the USS port, which is controlled by Parameter 2014, "USS telegram off time". Once the MicroGate has established communications with an SED2 drive with the watchdog function enabled, the watchdog timer is activated. If communications are subsequently lost for the specified length of time, the SED2 will automatically generate a F0072 fault. Setting Parameter 2014 to a value of 0 disables the watchdog timer function. Setting Parameter 2014 to a non-zero value enables the watchdog timer function with the specified time. Avoid setting this value too low, as that could result in false fault indications.

Verifying the Installation

After all necessary connections have been made, power up the SED2 drive and the MicroGate, and wait approximately 5 seconds. If the MicroGate has been installed correctly, the STAT led will be flashing green, and the LCL led will be alternating so fast between red and green that it will appear to be glowing amber.

If the MicroGate is set up as an MS/TP Master, and it is connected to a BACnet network, the NET led will be alternating between red and green. If the MicroGate is set up as an MS/TP Slave, the NET led will be flickering red (it will only flash green when it responds to a request from a master).

To verify that the MicroGate and drive are set up correctly, send the following Write Property requests to the network port of the MicroGate:

- CMD SRC (MV 0) → 5 (USS on COM Link)
- SP SRC 1 (MV 1) → 5 (USS on COM Link)
- FREQ SP (AV 23) → 50.0 (%)
- RUN ENA CMD (BV 11) → 1 (ENABLE)
- RUN CMD 3 (BV 10) → 1 (ON)
- RUN CMD 2 (BV 9) → 1 (ON)
- RUN CMD 1 (BV 8) → 1 (ON)

At this point, if everything else is set up correctly, the drive should start running. The drive frequency may be changed at any time during this process by writing to the FREQ SP again.

BACNET OBJECTS

The following tables contain the list of all BACnet objects available on the MicroGate.

Table 9 - Binary Input Objects Supported

Instance	Object Name	Description	ACTIVE Text	Inactive Text	Present Value Access Type	Mapped to
BI 0	DO 1 ACT	Actual Value of Digital Output #1	ON	OFF	R	r0747:0
BI 1	DO 2 ACT	Actual Value of Digital Output #2	ON	OFF	R	r0747:1
BI 3	DI 1 ACT	Actual Value of Digital Input #1	ON	OFF	R	r0722:0
BI 4	DI 2 ACT	Actual Value of Digital Input #2	ON	OFF	R	r0722:1
BI 5	DI 3 ACT	Actual Value of Digital Input #3	ON	OFF	R	r0722:2
BI 6	DI 4 ACT	Actual Value of Digital Input #4	ON	OFF	R	r0722:3
BI 7	DI 5 ACT	Actual Value of Digital Input #5	ON	OFF	R	r0722:4
BI 8	DI 6 ACT	Actual Value of Digital Input #6	ON	OFF	R	r0722:5
BI 9	DI 7 ACT	Actual Value of Digital Input #7	ON	OFF	R	r0722:6
BI 10	DI 8 ACT	Actual Value of Digital Input #8	ON	OFF	R	r0722:7

Table 10 - Binary Value Objects Supported

Instance	Object Name	Description	Active Text	Inactive Text	Present Value Access Type	Mapped to
BV 0	STOP/RUN ACT	Indicates whether inverter is running or stopped, regardless of control source	STOP	RUN	R	ZSW:2
BV 1	FWD/REV ACT	Indicates whether the inverter is running in forward or reverse	FWD	REV	R	ZSW:14
BV 2	RUN ENA ACT	Indicates whether the inverter is enabled	ENABLE	DISABLE	R	ZSW:0
BV 3	RDY TO RUN	Indicates whether the inverter is ready to run	YES	NO	R	ZSW:1
BV 4	AT MAX FREQ	Indicates whether the maximum frequency has been reached	YES	NO	R	ZSW:10
BV 5	AT SETPOINT	Indicates whether there is no deviation between the setpoint and the actual value	YES	NO	R	ZSW:8
BV 6	FAULT ACT	Indicates whether there is an active fault in the inverter	FAULT	OK	R	ZSW:3
BV 7	WARN ACT	Indicates whether there is an active warning in the inverter	WARN	OK	R	ZSW:7
BV 8	RUN CMD 1	1 = ok to run (edge controlled), 0 = shutdown via ramp	ON	OFF	C	STW:0
BV 9	RUN CMD 2	1 = ok to run, 0 = coast to stop	ON	OFF	C	STW:1
BV 10	RUN CMD 3	1 = ok to run, 0 = fast stop	ON	OFF	C	STW:2
BV 11	RUN ENA CMD	Enable the inverter to run	ENABLE	DISABLE	C	STW:3
BV 12	FWD/REV CMD	Run in forward or reverse	REV	FWD	C	STW:11
BV 13	FAULT ACK	Acknowledge a fault	ACK	NO ACK	W	STW:7
BV 14	ENABLE PID	Enable PID Controller	ENABLE	DISABLE	W	P2200
BV 15	CDS	Command Data Set Bit 0 (local/remote)	YES	NO	C	STW:15
BV 16	DO 1 CMD	Commanded Value of Digital Output #1	ON	OFF	W	P0731
BV 17	DO 2 CMD	Commanded Value of Digital Output #2	ON	OFF	W	P0732
BV 30	HAND/AUTO	Hand/Auto function	HAND	AUTO	W	P0718

Table 11 - Analog Value Objects Supported

Instance	Object Name	Description	Units	Present Value Access Type	Mapped to
AV 0	OUTPUT SPEED	Indicates actual filtered rotor speed	RPM	R	r0022
AV 1	OUTPUT FREQ	Indicates actual filtered output frequency	Hertz	R	r0024
AV 2	DC BUS VOLT	Indicates the actual filtered DC-link voltage	Volts	R	r0026
AV 3	OUTPUT VOLT	Indicates the actual filtered output voltage	Volts	R	r0025
AV 4	CURRENT	Indicates the actual filtered output current	Amps	R	r0027
AV 5	TORQUE	Indicates the actual filtered torque	Newton Meters	R	r0031
AV 6	POWER ACT	Indicates the actual filtered power	Kilowatts	R	r0032
AV 8	MOTOR TEMP	Indicates the measured temperature of the motor	°C	R	r0035
AV 9	KWH	Indicates the electrical energy used by the inverter	Kilowatt Hours	R	r0039
AV 10	PID SP ACT	Indicates the actual setpoint value of the motor potentiometer (PID)	Percent	R	r2250
AV 11	PID OUTPUT	Indicates the actual PID output	Percent	R	r2294
AV 13	FREQ SP ACT	Indicates the actual frequency setpoint of the inverter	Hertz	R	r0020
AV 14	FREQ ACT	Indicates the actual frequency of the inverter	Percent	R	HIW (0-4000h = 0-100%)
AV 15	INV FW VER	Indicates the version of the firmware in the inverter	--	R	r0018
AV 16	INV MODEL	Indicates the power stack code of the inverter	--	R	r0200
AV 17	RATED POWER	Indicates the rated power of the inverter	Kilowatts	R	r0206
AV 18	LAST FLT	Indicates the most recent fault in the fault log	--	R	r0947
AV 19	PREV FLT 1	Indicates a previous fault in the fault log	--	R	r0947
AV 20	PREV FLT 2	Indicates a previous fault in the fault log	--	R	r0947
AV 21	PREV FLT 3	Indicates a previous fault in the fault log	--	R	r0947
AV 22	LAST WARN	Indicates the most recent warning in the warning log	--	R	r2110
AV 23	FREQ SP	The setpoint frequency of the inverter, as a percentage of the reference frequency	Percent	C	HSW (0-4000h = 0-100%)
AV 24	FREQ REF	The reference frequency for the inverter	Hz	W	P2000
AV 25	PID SP REF	Setpoint for the motor potentiometer (PID)	Percent	W	P2240
AV 26	CUR LIM	Motor overload current limit, relative to rated motor current	Percent	W	P0640
AV 27	ACCEL TIME	The ramp up time of the inverter	Seconds	W	P1120
AV 28	DECEL TIME	The ramp down time of the inverter	Seconds	W	P1121
AV 29	PID UP LMT	The upper limit for PID controller output	Percent	W	P2291
AV 30	PID LO LMT	The lower limit for PID controller output	Percent	W	P2292
AV 31	P GAIN	The proportional gain for the PID controller	--	W	P2280
AV 32	I GAIN	The integral time constant for the PID controller	Seconds	W	P2285
AV 33	D GAIN	The derivative time for the PID controller	Seconds	W	P2274
AV 34	PID FB GAIN	The gain applied to PID feedback	Percent	W	P2269
AV 35	PID FILTER	The time constant for the PID feedback filter	Seconds	W	P2265

Table 12 - Analog Input Objects Supported

Instance	Object Name	Description	Units	Present Value Access Type	Mapped to
AI 0	AO 1 ACT	Indicates actual value of Analog Output #1 after filtering and scaling	--	R	r0774[0]
AI 1	AO 2 ACT	Indicates actual value of Analog Output #2 after filtering and scaling	--	R	r0774[1]
AI 2	AI 1 ACT	Indicates actual value of Analog Input #1 after scaling	Percent	R	r0754[0]
AI 3	AI 2 ACT	Indicates actual value of Analog Input #2 after scaling	Percent	R	r0754[1]
AI 4	AI 1 RAW	Indicates actual value of Analog Input #1 before scaling	--	R	r0752[0]
AI 5	AI 2 RAW	Indicates actual value of Analog Input #2 before scaling	--	R	r0752[1]

Table 13 - Multistate Value Objects Supported

Instance	Object Name	Description	Number of States	States	Present Value Access Type	Mapped to
MV 0	CMD SRC	Selection of the command source for the inverter	7	1: BOP (keypad) 2: terminal 3: <unused> 4: USS on BOP link 5: USS on COM link 6: CB on COM link 7: factory default	W	P0700[0][1]
MV 1	SP SRC 1	Selection of the main frequency setpoint for the inverter	8	1: MOP setpoint 2: analog setpoint 3: fixed frequency 4: USS on BOP link 5: USS on COM link 6: CB on COM link 7: analog setpoint 2 8: none	W	P1000[0][2]
MV 2	SP SRC 2	Selection of an additional frequency setpoint for the inverter	8	1: MOP setpoint 2: analog setpoint 3: fixed frequency 4: USS on BOP link 5: USS on COM link 6: CB on COM link 7: analog setpoint 2 8: none	W	P1000[0][2]

[1]Changing the Present Value of this object will cause several internal parameters in the inverter to be changed.
[2]Commanding either MV1 or MV2 will cause P1000 to be written to the inverter with a combined value.

In the above tables, the Present Value Access Type indicates whether the present value of an object is read-only (R), writeable (W) or commandable (C). Commandable objects use a priority array.

If the MicroGate fails to read a parameter from the SED2 drive for some reason, any object(s) associated with that parameter are marked as Out Of Service until the parameter is successfully read from the drive.

If the MicroGate loses communications with the SED2 drive altogether, all objects are marked as Out Of Service until communications can be reestablished and a new value is read from the drive for that object.

It is possible for certain parameters in the SED2 drive to be assigned a value via the drive keypad interface inconsistent with the values in the above tables. For example, DO 1 CMD and DO 2 CMD may be assigned values other than 0 or 1 (when the states of the associated digital outputs are to be driven by other parameters rather than directly). In such a case, the object will be marked as Unreliable until such time as the value of the parameter in the SED2 drive again corresponds to a value consistent with the object type.