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1. Introduction

The Metasys® N2 communication option for the **GPD505** and **GPD506/P5** allows these drives to be integrated into a new or existing Metasys® environment.

This manual describes the steps necessary for hardware installation, network identification, and operation of the interface. Refer to the appropriate Technical Manual for additional information regarding drive operation and setup.

2. Hardware Installation

This section describes steps necessary to install the option card and configure the drive for its use. Since this option is available pre-installed or in kit form, many of these steps may have been completed at the factory. If already installed, users should still review these steps to become familiar with the procedure.

Refer to **Figure 1** for the physical location of switches, LEDs and connectors.

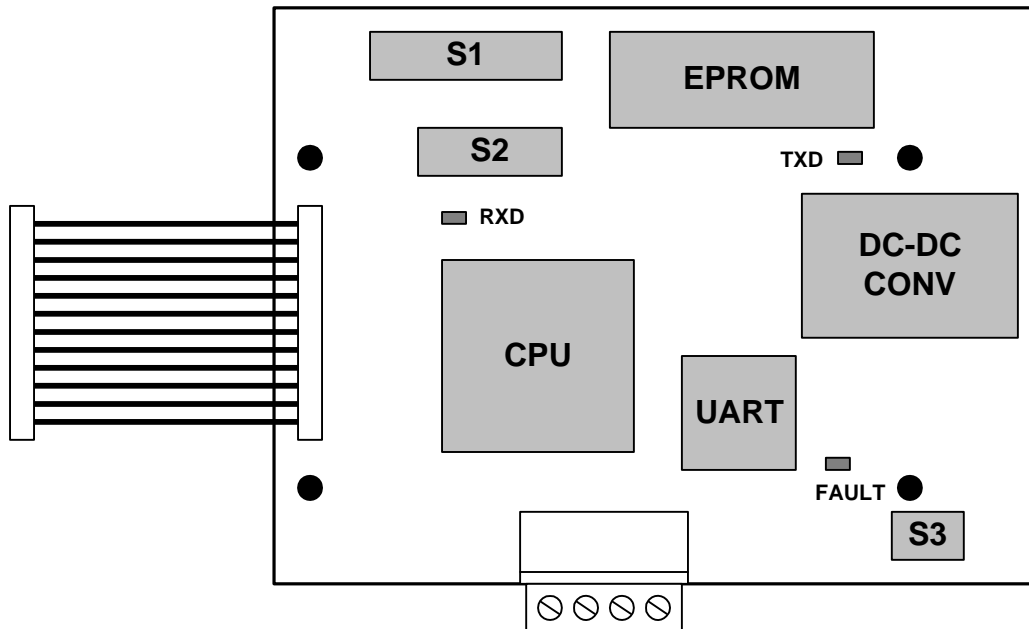


Figure 1. Option Card Layout

2.1 Option Card Mounting

CAUTION: Make sure that the input power to the drive is **TURNED OFF** and the **CHARGE** lamp inside the unit is **OFF** before installing the option card.

Step 1. Remove the digital operator, applying pressure to the locking plate on its lower right side, as illustrated in **Figure 2**. Lift the operator out by pulling forward.

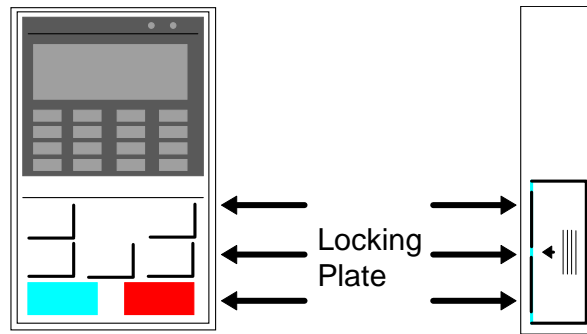


Figure 2. Operator Removal

- Step 2.** Remove the drive cover, applying pressure to the locking tabs on either side of the cover as illustrated in **Figure 3**. With the locking tabs disengaged, pivot the cover out from the bottom. Continue pivoting it until the top hinge disengages.

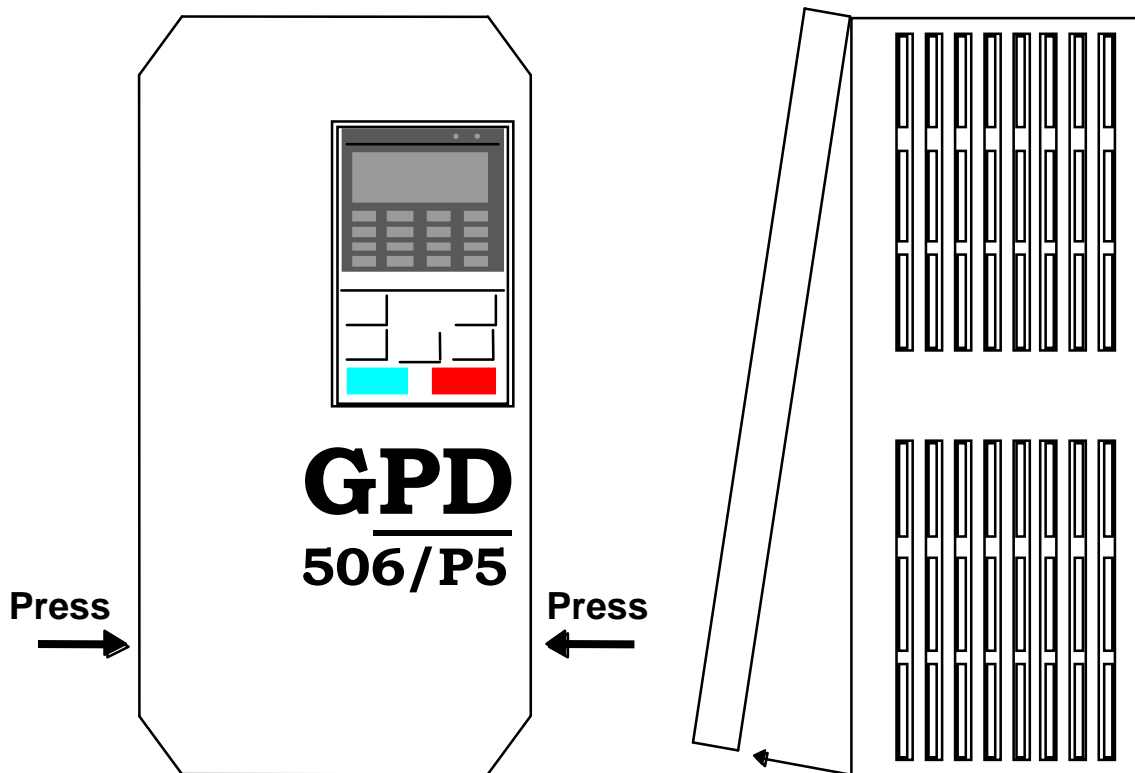


Figure 3. Cover Removal

- Step 3.** Position the option card so that the 12-pin interface cable is to the left, as illustrated in **Figure 4**. Carefully press the attached cable connector into connector 2CN until it is firmly seated. Please note the orientation of the locking tab relative to the connector mounted on the control board.
- Step 4.** Position the option board mounting holes directly over the four standoffs on the control board. Carefully press the option board onto the standoffs until it is firmly seated.

- Step 5.** Route the green pigtail lead from the option board to the lower left corner of the control board and connect it to screw terminal **E(G)**.

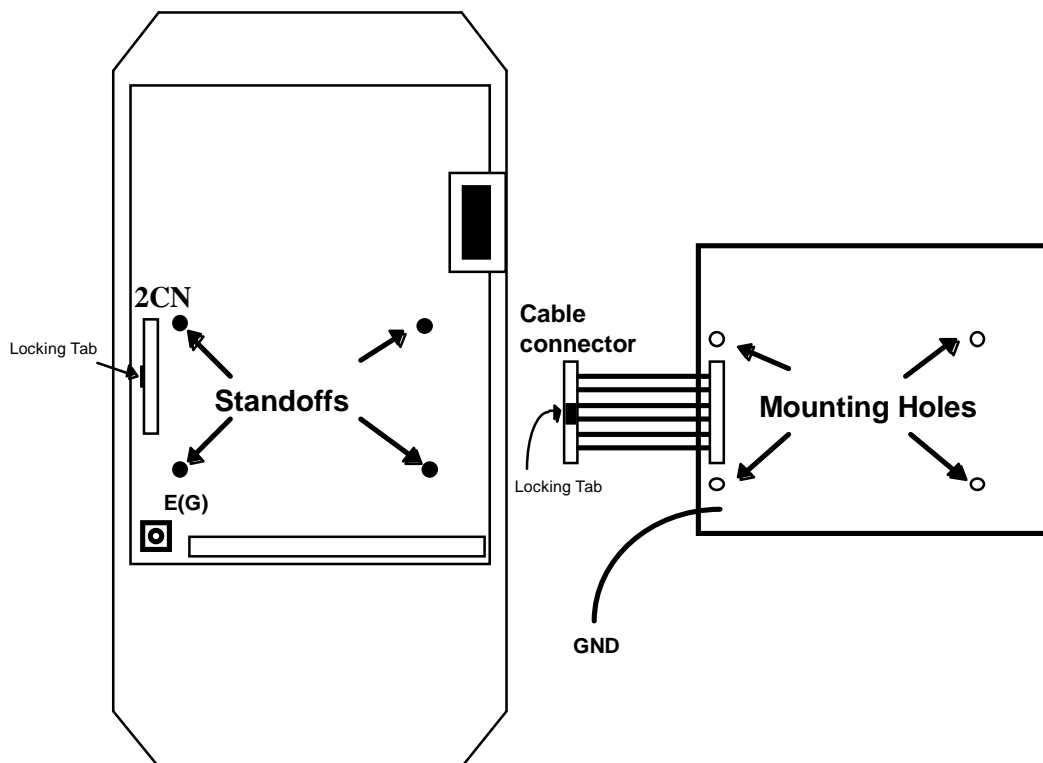


Figure 4. Option Card Positioning

2.2 Drive Set-up

The drive must be properly configured to communicate with the option card, as described below:

GPD505 Parameter	GPD506 Parameter	Setting	Description
n106	n104	1	Address (01)
n107	n105	2	Baud Rate (9600)
n108	n106	0	Parity (None)

NOTE: Parameter n001 must be set to 3 to change these parameters. New settings will not take affect until drive power is cycled.

If any of these settings are incorrect, “**CALL**” will blink on the digital operator, as will the RXD, TXD and FAULT LEDs. This is an indication that the drive has not yet established communication with the option card. Once the drive has properly exchanged messages with the option card, all blinking should stop.

2.3 Network Connection

Communication on the network is half-duplex, two-wire RS-485, with communication parameters fixed at 9600 baud, eight data bits, no parity and one start/stop bit. The connection medium is shielded twisted pair cable.

Network connection is facilitated by a pluggable 4-way Phoenix-style connector, as illustrated in **Figure 5**. Particular attention should be given to the polarity of the network connection. Proper communication cannot be established with these terminals reversed.

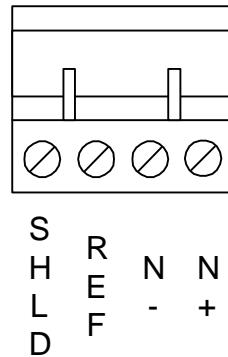


Figure 5. Network Connector

2.3.1 Bus Terminating Resistor

A bus terminating resistor (120Ω) is available on each option board and can be applied to the bus by setting the switches of S3 to their ON position.

In a multi-node system, only those nodes at the end of a bus segment should have terminating resistors. Before applying a terminating resistor as described above, care should be taken to understand the physical layout of the network and where other resistors might already be applied. An overloaded bus may not function properly.

2.4 Network Addressing

A drive's network address is assigned by selecting the proper setting for switch S1, as detailed in **Table 1**:

Network Address	S1 Setting 87654321	Network Address	S1 Setting 87654321	Network Address	S1 Setting 87654321	Network Address	S1 Setting 87654321
N/A	00000000	64	01000000	128	10000000	192	11000000
1	00000001	65	01000001	129	10000001	193	11000001
2	00000010	66	01000010	130	10000010	194	11000010
3	00000011	67	01000011	131	10000011	195	11000011
4	00000100	68	01000100	132	10000100	196	11000100
5	00000101	69	01000101	133	10000101	197	11000101
6	00000110	70	01000110	134	10000110	198	11000110
7	00000111	71	01000111	135	10000111	199	11000111
8	00001000	72	01001000	136	10001000	200	11001000
9	00001001	73	01001001	137	10001001	201	11001001
10	00001010	74	01001010	138	10001010	202	11001010
11	00001011	75	01001011	139	10001011	203	11001011
12	00001100	76	01001100	140	10001100	204	11001100
13	00001101	77	01001101	141	10001101	205	11001101
14	00001110	78	01001110	142	10001110	206	11001110
15	00001111	79	01001111	143	10001111	207	11001111
16	00010000	80	01010000	144	10010000	208	11010000
17	00010001	81	01010001	145	10010001	209	11010001
18	00010010	82	01010010	146	10010010	210	11010010
19	00010011	83	01010011	147	10010011	211	11010011
20	00010100	84	01010100	148	10010100	212	11010100
21	00010101	85	01010101	149	10010101	213	11010101
22	00010110	86	01010110	150	10010110	214	11010110
23	00010111	87	01010111	151	10010111	215	11010111
24	00011000	88	01011000	152	10011000	216	11011000
25	00011001	89	01011001	153	10011001	217	11011001
26	00011010	90	01011010	154	10011010	218	11011010
27	00011011	91	01011011	155	10011011	219	11011011
28	00011100	92	01011100	156	10011100	220	11011100
29	00011101	93	01011101	157	10011101	221	11011101
30	00011110	94	01011110	158	10011110	222	11011110
31	00011111	95	01011111	159	10011111	223	11011111
32	00100000	96	01100000	160	10100000	224	11100000
33	00100001	97	01100001	161	10100001	225	11100001
34	00100010	98	01100010	162	10100010	226	11100010
35	00100011	99	01100011	163	10100011	227	11100011
36	00100100	100	01100100	164	10100100	228	11100100
37	00100101	101	01100101	165	10100101	229	11100101
38	00100110	102	01100110	166	10100110	230	11100110
39	00100111	103	01100111	167	10100111	231	11100111
40	00101000	104	01101000	168	10101000	232	11101000
41	00101001	105	01101001	169	10101001	233	11101001
42	00101010	106	01101010	170	10101010	234	11101010
43	00101011	107	01101011	171	10101011	235	11101011
44	00101100	108	01101100	172	10101100	236	11101100
45	00101101	109	01101101	173	10101101	237	11101101
46	00101110	110	01101110	174	10101110	238	11101110
47	00101111	111	01101111	175	10101111	239	11101111
48	00110000	112	01110000	176	10110000	240	11110000
49	00110001	113	01110001	177	10110001	241	11110001
50	00110010	114	01110010	178	10110010	242	11110010
51	00110011	115	01110011	179	10110011	243	11110011
52	00110100	116	01110100	180	10110100	244	11110100
53	00110101	117	01110101	181	10110101	245	11110101
54	00110110	118	01110110	182	10110110	246	11110110
55	00110111	119	01110111	183	10110111	247	11110111
56	00111000	120	01111000	184	10111000	248	11111000
57	00111001	121	01111001	185	10111001	249	11111001
58	00111010	122	01111010	186	10111010	250	11111010
59	00111011	123	01111011	187	10111011	251	11111011
60	00111100	124	01111100	188	10111100	252	11111100
61	00111101	125	01111101	189	10111101	253	11111101
62	00111110	126	01111110	190	10111110	254	11111110
63	00111111	127	01111111	191	10111111	255	11111111

Table 1. Network Address Settings

3. Application Overview

The drive is configured, controlled, and monitored by a comprehensive set of Analog and Binary objects, as illustrated in **Figure 6**. Note the convention regarding inputs and outputs (i.e. Network Output = Drive Input, Network Input = Drive Output).

This chapter summarizes the available objects by their type. Additional detail can be found in **Section 4, Standard Operation**, where objects are grouped together by function.

NOTE: The Metasys® Change of State (COS) feature is fully supported by this application.

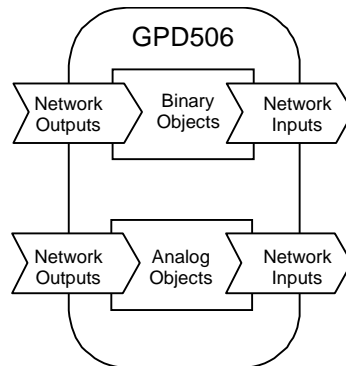


Figure 6. Device Overview

3.1 Analog Input Object Summary

Object ID	Object Name	GPD505 Monitor	GPD506 Monitor	Units	Min	Max
AI1	Speed Reference	U-01	U-01	Note 1	0	Note 1
AI2	Output Speed	U-02	U-02	Note 1	0	Note 1
AI3	Output Current	U-03	U-03	A	0	Note 2
AI4	Kilowatt Hour Meter	n/a	U-15	kWh	0	9999
AI5	Output Power	n/a	U-06	kW	0	9999
AI6	Drive Temperature	n/a	Note 3	°C		
AI7	PID Feedback	n/a	U-13	Note 1	0	Note 1
AI8	AC Output Voltage	U-04	U-04	V	0	Note 2
AI9	DC Bus Voltage	U-05	U-05	V	0	Note 2
AI10	Fault Code	U-09	U-09		0	8191
AI11	Elapsed Timer – Hrs	U-11	U-11	Hr	0	9999
AI12	Elapsed Timer – 10K Hrs	U-12	U-12	10K Hr	0	27
AI13	Megawatt Hour Meter	n/a	U-16	mWh	0	9999
AI14	Drive Rated Current	Note 3	Note 3	A	Note 2	Note 2
AI15	Read Parameter Data	Note 4	Note 4	Note 4	Note 4	Note 4

Notes

1. Value dependent on setting of **AO17**, Operator Display Mode. Refer to **Section 4.1.9**.
2. Value dependent on drive capacity. Refer to appropriate Technical Manual.
3. Internal value only available via serial communication.
4. Value depends on the parameter being read (**AO21**).

3.2 Analog Output Object Summary

Object ID	Object Name	GPD505 Parameter	GPD506 Parameter	Units	Default	Min	Max
AO1	Speed Command	n/a	n/a	Note 1	0	0	Note 1
AO2	Acceleration Time	n019	n018	Sec	10.0	0	3600.0
AO3	Deceleration Time	n020	n019	Sec	10.0	0	3600.0
AO4	PID Proportional Gain	n086	n086	-	1.0	0.0	10.0
AO5	PID Integral Time	n087	n087	Sec	10.0	0.0	100.0
AO6	Stall Prevention Level – Run	n072	n074	%	Note 2	30	200
AO7	Stall Prevention Level – Accel	n071	n073	%	Note 2	30	200
AO8	Operational Mode Select	n002	n002	-	3	0	8
AO9	PID Mode Select	n084	n084	-	0	0	3
AO10	Freq Command Upper Limit	n030	n031	%	100	0	109
AO11	Freq Command Lower Limit	n031	n032	%	0	0	100
AO12	Motor Rated Current	n032	n033	A	Note 2	Note 3	Note 3
AO13	First Prohibit Frequency	n058	n062	Hz	0.0	0.0	400.0
AO14	Second Prohibit Frequency	n059	n063	Hz	0.0	0.0	400.0
AO15	Prohibit Frequency BW	n060	n064	Hz	1.0	0.0	25.5
AO16	Number of Auto Restarts	n056	n060	-	0	0	10
AO17	Operator Display Mode	n024	n023	-	0	0	3999
AO18	Power Loss Ride-Through	n051	n055	-	0	0	2
AO19	Cable Loss Timeout	n/a	n/a	Sec	0	0	3600.0
AO20	Cable Loss Speed	n/a	n/a	Note 1	0	0	Note 1
AO21	Read Parameter Number	n/a	n/a	-	0	1	114
AO22	Write Parameter Number	n/a	n/a	-	0	1	114
AO23	Write Parameter Data	n/a	n/a	-	0	0	9999

Notes

1. Value dependent on setting of **AO17**, Operator Display Mode. Refer to **Section 4.1.9**.
2. Value dependent on drive capacity. Refer to appropriate Technical Manual.
3. Proper setting is between 10% and 120% of drive's output current rating (**AI14**).

3.3 Binary Input Object Summary

Object ID	Object Name	Default	Off (0) State	On (1) State
BI1	Run/Stop Monitor	0	Stopped	Running
BI2	Forward/Reverse Monitor	0	Forward	Reverse
BI3	Drive Ready Monitor	0	Not Ready	Ready
BI4	Fault Monitor	0	Not Faulted	Faulted
BI5	Drive Comm Error Monitor	0	No Error	Drive Comm Error
BI6	Multifunction Output 1	0	Note 1	Note 1
BI7	Multifunction Output 2	0	Note 1	Note 1
BI8	Safety Interlock Monitor	0	Safety Clear (Term S1 closed)	Safety Set (Term S1 open)

Notes

1. States are dependent on the setup of the Multifunction Outputs. Refer to appropriate Technical Manual.

3.4 Binary Output Object Summary

Object ID	Object Name	Default	Off (0) State	On (1) State
BO1	Run/Stop Command	0	Stop	Run
BO2	Forward/Reverse Command	0	Forward	Reverse
BO3	Serial Fault (EF0) Command	0	No Fault	Fault

Object ID	Object Name	Default	Off (0) State	On (1) State
BO4	Fault Reset Command	0	No Reset	Reset
BO5	Multifunction Input 1	0	Depends on Terminal S3 function selection	Depends on Terminal S3 function selection
BO6	Multifunction Input 2	0	Depends on Terminal S4 function selection	Depends on Terminal S4 function selection
BO7	Multifunction Input 3	0	Depends on Terminal S5 function selection	Depends on Terminal S5 function selection
BO8	Multifunction Input 4	0	Depends on Terminal S6 function selection	Depends on Terminal S6 function selection
BO9	Panel Lock	0	Local/Remote and Stop/Reset keys enabled	Local/Remote and Stop/Reset keys disabled
B10	Communication Fault Enable	0	EF0 not declared if cable loss detected	EF0 declared if cable loss detected

Notes

1. States are dependent on the setup of the Multifunction Inputs. Refer to appropriate Technical Manual.

4. Standard Operation

The drive interface features 15 Analog Inputs, 23 Analog Outputs, 8 Binary Inputs and 10 Binary Outputs for configuring, controlling, and monitoring its operation.

This chapter describes each aspect of operation, grouping the objects together by function. Objects are summarized by type in **Section 3, Application Overview**.

4.1 Drive Configuration

This section describes the objects used to configure the drive. Refer to the appropriate Technical Manual for additional information.

4.1.1 Accel/Decel Times – AO2, AO3

These analog outputs define the ramp rates for starting and stopping the motor, configuring the drive as described below:

Object ID	Object Name	GPD505 Parameter	GPD506 Parameter	Units	Default	Min	Max
AO2	Acceleration Time	n019	n018	Sec	10.0	0	3600.0
AO3	Deceleration Time	n020	n019	Sec	10.0	0	3600.0

4.1.2 PID Configuration – AO4, AO5, AO9

These analog outputs define the gains and mode of the PID controller. The PID modes selectable by **A09** are described below:

AO9	PID Mode
0	PID Disabled
1	PID Enabled
2	PI with Feed Forward
3	Inverted PID

These objects configure the drive as described below:

Object ID	Object Name	GPD505 Parameter	GPD506 Parameter	Units	Default	Min	Max
AO4	PID Proportional Gain	n086	n086	-	1.0	0.0	10.0
AO5	PID Integral Time	n087	n087	Sec	10.0	0.0	100.0
AO9	PID Mode Select	n084	n084	-	0	0	3

4.1.3 Stall Prevention – AO6, AO7

These analog outputs define the stall prevention levels during acceleration and run. Each value is specified as a percentage of the drive's current rating (**AI14**). If the output current (**AI3**) reaches the specified level during acceleration or run, the output frequency is maintained or lowered as needed to sufficiently reduce the output current. These objects configure the drive as described below:

Object ID	Object Name	GPD505 Parameter	GPD506 Parameter	Units	Default	Min	Max
AO6	Stall Prevention Level – Run	n072	n074	%	Note 1	30	200
AO7	Stall Prevention Level – Accel	n071	n073	%	Note 1	30	200

Notes

- Value dependent on drive capacity. Refer to appropriate Technical Manual.

4.1.4 Operational Mode – AO8

This analog output defines the source for run and speed commands, as described below:

AO8	Run/Reverse Command Source	Speed Command Source	Remarks
0	Digital Operator	Digital Operator	AO1, BO1, BO2 have no affect.
1	External Terminals	Digital Operator	AO1, BO1, BO2 have no affect.
2	Digital Operator	External Terminals	AO1, BO1, BO2 have no affect.
3	External Terminals	External Terminals	AO1, BO1, BO2 have no affect.
4	Digital Operator	Network	AO1 sets speed command. BO1, BO2 have no affect
5	External Terminals	Network	AO1 sets speed command. BO1, BO2 have no affect
6	Network	Network	AO1 sets speed command. BO1 sets run command. BO2 sets forward/reverse command.
7	Network	Digital Operator	AO1 has no affect. BO1 sets run command. BO2 sets forward/reverse command.
8	Network	External Terminals	AO1 has no affect. BO1 sets run command. BO2 sets forward/reverse command.

This object configures the drive as described below:

Object ID	Object Name	GPD505 Parameter	GPD506 Parameter	Units	Default	Min	Max
AO8	Operational Mode Select	n002	n002	-	3	0	8

4.1.5 Speed Command Limits – AO10, AO11

These analog outputs define the upper and lower speed command limits. Each value is specified as a percentage of the maximum drive output frequency, defined by **GPD505** parameter **n012** or **GPD506** parameter **n011**. These objects configure the drive as described below:

Object ID	Object Name	GPD505 Parameter	GPD506 Parameter	Units	Default	Min	Max
AO10	Freq Command Upper Limit	n030	n031	%	100	0	109
AO11	Freq Command Lower Limit	n031	n032	%	0	0	100

4.1.6 Motor Rated Current – AO12

This analog output defines the current rating of the motor, configuring the drive as described below:

Object ID	Object Name	GPD505 Parameter	GPD506 Parameter	Units	Default	Min	Max
AO12	Motor Rated Current	n032	n033	A	Note 1	Note 2	Note 2

Notes

1. Value dependent on drive capacity. Refer to appropriate Technical Manual.
2. Proper setting is between 10% and 120% of drive's output current rating (**AI14**).

4.1.7 Prohibit Frequencies – AO13, AO14, AO15

These analog outputs define bands of prohibited frequencies, selected to avoid certain areas of resonant motor vibration. Two separate bands can be defined, with a common bandwidth. When this feature is selected, the motor is accelerated and decelerated through the prohibited areas. These objects configure the drive as described below:

Object ID	Object Name	GPD505 Parameter	GPD506 Parameter	Units	Default	Min	Max
AO13	First Prohibit Frequency	n058	n062	Hz	0.0	0.0	400.0
AO14	Second Prohibit Frequency	n059	n063	Hz	0.0	0.0	400.0
AO15	Prohibit Frequency BW	n060	n064	Hz	1.0	0.0	25.5

4.1.8 Automatic Restarts – AO16

This analog output defines the number of automatic restarts that will be attempted under certain fault conditions, as described below:

Restartable Faults

- Overcurrent (oC), Overvoltage (ou), Undervoltage (Uu1), Ground Fault (GF)

Non-Restartable Faults

- Overload (oL_), External (EF_), Hardware (CPF_), Fuse Blown (PUF)
- Overcurrent (oC) or Overvoltage (ou) during deceleration
- When Power Loss Ride-Through is disabled (**AO18 = 0**)

This object configures the drive as described below:

Object ID	Object Name	GPD505 Parameter	GPD506 Parameter	Units	Default	Min	Max
AO16	Number of Auto Restarts	n056	n060	-	0	0	10

4.1.9 Display Units – AO17

This analog output defines the display units for speed data (**AO1, AO20, AI1, AI2, AI7**), as described below:

AO17	Display Units	Description
0	Hz	Speed in Hertz (default)
1	%	% of maximum drive frequency, specified by GPD505

AO17	Display Units	Description
		parameter n012 or GPD506 parameter n011
2-39	rpm	Specifies number of motor poles (P). Speed is calculated by : $N_s = 120 \cdot f / P$.
40 - 3999	custom	Specifies desired reading at maximum output frequency, where the lower 3 digits indicate the unscaled reading and the upper digit places the decimal point. The output frequency range is linearly converted to this new range. For example: If the display range is desired to be 0.0 – 14.7, AO17 is set to 1147 .

This object configures the drive as described below:

Object ID	Object Name	GPD505 Parameter	GPD506 Parameter	Units	Default	Min	Max
AO17	Operator Display Mode	n024	n023	-	0	0	3999

4.1.10 Power Loss Ride-Through – AO18

This analog output defines how the drive will react to a momentary power loss, as described below:

AO18	Ride-Through Mode
0	Ride-Through Disabled
1	Ride-Through Enabled for up to 2 seconds
2	Ride-Through Enabled indefinitely, provided control power is maintained

This object configures the drive as described below:

Object ID	Object Name	GPD505 Parameter	GPD506 Parameter	Units	Default	Min	Max
AO18	Power Loss Ride-Through	n051	n055	-	0	0	2

4.1.11 General Purpose Setup – AO22, AO23

Two analog outputs are defined for setting any drive parameter:

AO22 - Specifies the drive parameter to be set. Writing to this object initiates the write sequence.

AO23 - Specifies the value to be written to the specified parameter. Writing to this object completes the write sequence and causes the value to be sent to the drive.

Refer to the appropriate Technical Manual for a detailed description of all parameters.

NOTE: The increment listed in the Technical Manual must be considered when specifying a value. For example, to set GPD506 parameter n070 (GPD505 n066), **DC Injection Time at Stop**, to 1 second, AO23 must be set to 10, since the increment for this parameter is 0.1 seconds.

4.2 Drive Command and Control

This section describes the objects used to command and control the drive. Refer to the appropriate Technical Manual for additional information.

4.2.1 Run/Stop Command – BO1

This binary input controls the run/stop command to the drive, as described below. The drive must be configured for a network Run/Stop Command (**AO8 = 6,7,8**) for this input to control the drive.

Object ID	Object Name	Default	Off (0) State	On (1) State
BO1	Run/Stop Command	0	Stop	Run

4.2.2 Speed Command – AO1

This analog input sets the speed command to the drive, as described below. The drive must be configured for a network Speed Command (**AO8 = 4,5,6**) for this input to control the drive.

Object ID	Object Name	GPD505 Parameter	GPD506 Parameter	Units	Default	Min	Max
AO1	Speed Command	n/a	n/a	Note 1	0	0	Note 1

Notes

1. Value dependent on setting of **AO17**, Operator Display Mode. Refer to **Section 4.1.9**.

4.2.3 Forward/Reverse Command – BO2

This binary input controls the Forward/Reverse command to the drive, as described below. The drive must be configured for a network Forward/Reverse Command (**AO8 = 6,7,8**) for this input to control the drive.

Object ID	Object Name	Default	Off (0) State	On (1) State
BO2	Forward/Reverse Command	0	Forward	Reverse

4.2.4 Fault/Fault Reset Commands – BO3, BO4

These binary outputs provide fault and fault reset control, as described below. These commands control the drive for all settings of **AO8**.

Object ID	Object Name	Default	Off (0) State	On (1) State
BO3	Serial Fault (EF0) Command	0	No Fault	Fault
BO4	Fault Reset Command	0	No Reset	Reset

4.2.5 MultiFunction Input Commands – BO5, BO6, BO7, BO8

These binary outputs control the multifunction input commands, as described below. These commands are equivalent to contact closures on external terminals S3 - S6, respectively. Function selection for the multifunction inputs is configured in **GPD505** parameters **n036-n039** and **GPD506** parameters **n037-n040**.

Object ID	Object Name	Default	Off (0) State	On (1) State
BO5	Multifunction Input 1 Command	0	Depends on Terminal S3 function selection	Depends on Terminal S3 function selection
BO6	Multifunction Input 2 Command	0	Depends on Terminal S4 function selection	Depends on Terminal S4 function selection
BO7	Multifunction Input 3 Command	0	Depends on Terminal S5 function selection	Depends on Terminal S5 function selection
BO8	Multifunction Input 4 Command	0	Depends on Terminal S6 function selection	Depends on Terminal S6 function selection

NOTE: These objects also report the active state of a multifunction input asserted at the external terminals (S3 – S6).

4.2.6 Panel Lock Command – BO9

This binary output enables and disables the Local/Remote and Stop/Reset keys of the digital operator, as described below.

Object ID	Object Name	Default	Off (0) State	On (1) State
BO9	Panel Lock Command	0	Local/Remote and Stop/Reset keys enabled	Local/Remote and Stop/Reset keys disabled

4.2.7 Terminal S1 Run/Stop Control

In certain applications, a normally closed system safety may be wired to the drive's terminal S1. The basis for this design is a hard-wired run command at terminal S1. If a safety is placed in series with this run contact, the drive stops when the safety opens.

With this option card, the same functionality can be achieved with a network run command. It is enabled by setting **GPD505** parameter **n039** to **19** or **GPD506** parameter **n040** to **21**. With this feature enabled, a network run command starts the drive only if the contact on S1 is closed. If the contact opens, the drive is stopped and then restarted once the contact closes.

4.3 Drive Monitoring

This section describes the objects used to monitor the drive. Refer to the appropriate Technical Manual for additional information.

4.3.1 Operating Status – AI1-AI13, BI1-BI8

The following table summarizes the input objects available for monitoring the operating status of the drive.

Operating Variable	Object ID	Description																																							
Speed Reference	AI1	Reports the speed reference as commanded from the source selected by AO8 (operator, terminal, or network). This allows speed reference to be monitored even when the network is not the command source. This value matches AO1 only when the network is selected as the command source (AO8 = 4,5,6).																																							
Output Speed	AI2	Reports output speed.																																							
Output Current	AI3	Reports output current.																																							
Output Power	AI5	Reports output power. This object is only available on GPD506 drives.																																							
Drive Temperature	AI6	Reports drive temperature. This object is only available on GPD506 drives.																																							
AC Output Voltage	AI8	Reports AC output voltage (i.e. voltage applied to motor).																																							
DC Bus Voltage	AI9	Reports DC bus voltage.																																							
Kilowatt Hour Meter	AI4	Reports cumulative drive energy usage in kilowatts. This object is only available on GPD506 drives.																																							
Megawatt Hour Meter	AI13	Reports cumulative drive energy usage in megawatts. This object is only available on GPD506 drives.																																							
PID Feedback	AI7	Reports PID feedback. If PID is disabled, this value will be zero. This object is only available on GPD506 drives.																																							
Elapsed Timer – Hrs	AI11	Reports cumulative run time in hours.																																							
Elapsed Timer – 10K Hrs	AI12	Reports cumulative run time in increments of 10K hours.																																							
Fault Code	AI10	Reports drive fault status. This value is the decimal equivalent of a binary fault word. It is the sum of the values associated with each fault bit, as listed below: <table> <tr> <th>Fault</th><th>Bit</th><th>Value</th></tr> <tr> <td>Overcurrent, Ground, Short Circuit</td><td>0</td><td>1</td></tr> <tr> <td>Overvoltage</td><td>1</td><td>2</td></tr> <tr> <td>Drive Overload</td><td>2</td><td>4</td></tr> <tr> <td>Overheat</td><td>3</td><td>8</td></tr> <tr> <td>Main Circuit</td><td>5</td><td>32</td></tr> <tr> <td>Brake Transistor</td><td>6</td><td>64</td></tr> <tr> <td>External</td><td>7</td><td>128</td></tr> <tr> <td>Hardware</td><td>8</td><td>256</td></tr> <tr> <td>Motor Overload</td><td>9</td><td>512</td></tr> <tr> <td>During Undervoltage</td><td>11</td><td>2048</td></tr> <tr> <td>Power Loss</td><td>12</td><td>4096</td></tr> <tr> <td>Phase</td><td>13</td><td>8192</td></tr> </table>	Fault	Bit	Value	Overcurrent, Ground, Short Circuit	0	1	Overvoltage	1	2	Drive Overload	2	4	Overheat	3	8	Main Circuit	5	32	Brake Transistor	6	64	External	7	128	Hardware	8	256	Motor Overload	9	512	During Undervoltage	11	2048	Power Loss	12	4096	Phase	13	8192
Fault	Bit	Value																																							
Overcurrent, Ground, Short Circuit	0	1																																							
Overvoltage	1	2																																							
Drive Overload	2	4																																							
Overheat	3	8																																							
Main Circuit	5	32																																							
Brake Transistor	6	64																																							
External	7	128																																							
Hardware	8	256																																							
Motor Overload	9	512																																							
During Undervoltage	11	2048																																							
Power Loss	12	4096																																							
Phase	13	8192																																							
Run Status	BI1	Reports the run status (1=Run) as commanded from the source selected by AO8 (operator, terminal, or network). This allows the status to be monitored even when the network is not the command source. This value matches BO1 only when the network is selected as the command source (AO8 = 6,7,8).																																							
Forward/Reverse Status	BI2	Reports the forward/reverse status (1=Reverse) as commanded from the source selected by AO8 (operator, terminal, or network). This allows the status to be monitored even when the network is not the command source. This value matches BO2 only when the network is selected as the command source (AO8 = 6,7,8).																																							
Drive Ready Status	BI3	Reports whether or not the drive is ready to accept a run command (1=Ready).																																							
Fault Status	BI4	Reports the drive fault status (1=Fault).																																							

Operating Variable	Object ID	Description
Multifunction Output 1	BI5	Reports the status of Multifunction Output 1 (1=On). The function assigned to this output is programmed in GPD505 parameter n040 or GPD506 parameter n041 .
Multifunction Output 2	BI6	Reports the status of Multifunction Output 2 (1=On). The function assigned to this output is programmed in GPD505 parameter n041 or GPD506 parameter n042 .
Drive Comm Error	BI7	Reports the communication status between the option card and the drive (1=Comm Error).
Safety Interlock (Terminal S1)	BI8	Reports the status of a normally closed safety wired to Terminal S1 (1=Safety Set, Term S1 open).

4.3.2 Current Rating – AI14

This analog input reports the current rating of the drive. This information is useful in matching a motor to the drive and determining the settings for **AO6** (Stall Prevention Level during Run), **AO7** (Stall Prevention Level during Accel), and **AO12** (Motor Rated Current), all expressed in terms of the drive's current rating.

4.3.3 Reading Other Parameters – AO21, AI15

Two objects are defined for reading any drive parameter:

AO21 - Specifies the parameter to be read.

AI15 - Reports the value of the specified parameter.

Refer to the appropriate Technical Manual for a detailed description of all parameters.

NOTE: The increment listed in the Technical Manual must be considered when interpreting a reported value. For example, a read of GPD506 parameter n070 (GPD505 n066), DC Injection Time at Stop, which reports 10 in AI15 is actually a setting of 1, since the increment for this parameter is 0.1 seconds.

4.4 Cable Loss Behavior

This section describes the configurable cable loss feature of the option card. This feature offers a user maximum flexibility in determining the drive's response to a loss of communication.

After some interval without receipt of a message, the drive can be configured to respond in one of the following manners:

- Continue at last speed
- Continue at preset speed
- Stop
- Fault (EF0)

Three points are used to select the desired type of behavior:

- **AO19** – Cable Loss Timeout
- **AO20** – Cable Loss Speed
- **BO10** – Communication Fault Enable

The following table summarizes the settings for each type of behavior (*X = don't care*):

Behavior	Cable Loss Timeout (AO19)	Cable Loss Frequency (AO20)	Fault Enable (BO10)
Continue at last speed	0	X	X
Continue at preset speed	Timeout Interval	Preset Speed	Off
Stop Running	Timeout Interval	0	Off
Fault (EF0)	Timeout Interval	X	On

Each behavior is described in additional detail below.

Notes

1. Communication must first be established and then lost for these features to function as described. If a drive is powered-up without a cable connected or with the master controller offline, a timeout does not occur.
2. For modes which describe the drive running after a timeout, a run command must have been issued (**BO1 = 'On'**) prior to loss of communications. For safety purposes, it will not automatically start from a stopped condition. If a user requires the drive to start automatically, additional external wiring may be added to accomplish this (consult factory).
3. Upon expiration of the timeout interval, the FAULT LED lights and remains lit until communication is restored.

4.4.1 Continue Running at Last Speed

In this mode, Cable Loss Timeout (**AO19**) is set to **0**, disabling the cable loss feature. The other 2 settings (**BO10**, **AO20**) are ignored. If communication is lost, the drive simply maintains its last commanded state.

4.4.2 Continue Running at Preset Speed

In this mode, Cable Loss Timeout (**AO19**) is set to the desired interval and Cable Loss Speed (**AO20**) is set to the desired preset speed. If the time between messages exceeds the timeout interval, the drive's speed command (**AO1**) is set to the Cable Loss Speed (**AO20**) and the drive continues running at this new speed. Communication Fault Enable (**BO10**) must be set to **'Off'**.

4.4.3 Stop Running

In this mode, Cable Loss Timeout (**AO19**) is set to the desired interval and Cable Loss Speed (**AO20**) is set to **0**. If the time between messages exceeds the timeout interval, the drive's speed command (**AO1**) is set to **0** and the run command (**BO1**) is set to 'Off'. Communication Fault Enable (**BO10**) must be set to 'Off'.

4.4.4 Fault

In this mode, Cable Loss Timeout (**AO19**) is set to the desired interval and Communication Fault Enable (**BO10**) is set to 'On'. If the time between messages exceeds the timeout interval, an '**EF0**' fault is declared and the drive stops. Cable Loss Speed (**AO20**) is ignored.

5. Bypass Applications

For many applications, the drive is integrated into a **bypass** or **engineered** package. This type of package typically features an enclosure with contactors which allow the user to run the motor from line power (bypass mode) or from the drive (drive mode). This package also provides the flexibility for interfacing normally closed safety interlocks (firestat, freezestat, vibration sensors, etc.) which stop the drive if the contacts open.

5.1 Typical Parameter Settings

Because of the widespread use of this type of application, the following parameter set-up table is provided to aid in the start-up of such a drive.

GPD505 Parameter	GPD505 Setting	GPD506 Parameter	GPD506 Setting	Description
n001	3	n001	3	Enables Parameter Write Access
n002	6	n002	6	Operational Mode (Network Control)
n006	1	n006	1	Reverse Run Disabled
n007	0	n007	0	Local/Remote Button Disabled
n019	60	n018	60	Accel Time (secs)..
n020	60	n019	60	Decel Time (secs..
n025	10	n024	10	Initial Reference (Hz)
n026	6	n025	6	Alternate Reference (Hz)
n037	5	n038	5	Terminal S4 Select - Local/Remote
n038	9	n039	10	Terminal S5 Select - Manual Speed
n039	19	n040	21	Terminal S6 Select - PID Disable (see note)
n051	1	n055	1	Momentary Power Loss
n064	50	n068	50	DC Injection Braking Level (%)
n066	5	n070	5	DC Injection Time at Start (sec)
n103	1	n101	1	Modbus Timeout Enabled
n104	0	n102	0	Ramp to Stop on Modbus Timeout

NOTE: If safety interlocks are interfaced to the bypass package at Terminal S1 and a network run command is used, Terminal S6 Select must be set as listed to stop the motor if the safety opens.

6. Parameter Management Functions

Several parameter management functions have been included with the option card. These functions are accessed by setting all S1 switches off and using switch S2 to select the desired function, as summarized in Table 2 below:

Function	S1 Setting (87654321)	S2 Setting (654321)	Description
Save Parameter Settings	ALL OFF	000001	This function saves the current parameter settings to the option card.
Restore Parameter Settings	ALL OFF	000010	This function restores the parameter settings to the values saved in the option card.
Compare Parameter Settings	ALL OFF	000100	This function compares the current parameter settings to the values saved in the option card, displaying differences on the digital operator.

Table 2. User Function Switch Settings

NOTE: These functions detect the current drive type (GPD505/GPD506) as well as that of the image stored in the option card. If they differ, the functions will not complete and the ERROR LED will be lit.

6.1 Save Parameters

This function saves the current parameters to the option card.

This feature may be particularly useful to users as a final step in their setup procedure. Once a drive has been “fine-tuned” for a particular application, its unique setup can be saved for future use. A particular setup may then be recalled when replacing a drive, copying to other drives, or restoring a setup that has been altered.

To use this function, the following sequence should be observed:

1. Remove drive power.
2. Remove the network connection.
3. Select the desired function by setting switches S1 and S2 as described in Table 2.
4. Re-apply drive power.
5. Observe the RXD LED flashing. This occurs while the parameters are being read from the drive and stops when this step is complete.
6. Observe the TXD LED flashing. This occurs while the parameters are being written to the option card EEPROM and stops when this step is complete.
7. Upon successful completion of this function, the TXD LED remains on and all other LEDs should be off.
8. Remove drive power.
9. Reset switches S1 and S2 to their usual settings.
10. Attach the network connection.
11. Re-apply drive power.

6.2 Restore Parameters

This function restores the parameters to the values saved in the option card.

With a unique drive setup already saved in the option card, this feature may be used when replacing a drive, copying to other drives, or restoring a setup that has been altered.

To use this function, the following sequence should be observed:

1. Remove drive power.
2. Remove the network connection.
3. Select the desired function by setting switches S1 and S2 as described in Table 2.
4. Re-apply drive power.
5. Observe the RXD LED flashing. This occurs while the parameters are being read from the option card EEPROM stops when this step is complete.
6. Observe the TXD LED flashing. This occurs while the parameters are being written to the drive and stops when this step is complete.
7. Upon successful completion of this function, the TXD LED remains on and all other LEDs should be off. *If any errors occurred, the ERROR LED will be flashing. Monitor U-11 is used to display the data which failed to be written. The parameter number is displayed first, as '1xxx', where 'xxx' is the parameter number. The next value displayed is the value which failed to be written. The list of failed parameters is displayed repeatedly until power is removed.*
8. Remove drive power.
9. Reset switches S1 and S2 to their usual settings.
10. Attach the network connection.
11. Re-apply drive power.

6.3 Compare Parameters

This function compares the current parameters to the values saved in the option card, displaying differences on the digital operator.

With a unique drive setup already saved in the option card, this feature may be used to evaluate which parameters have been changed since the setup was saved. This may be particularly useful in summarizing parameter changes during a troubleshooting process or determining what changes have been made since a drive's initial installation.

To use this function, the following sequence should be observed:

1. Remove drive power.
2. Remove the network connection.
3. Select the desired function by setting switches S1 and S2 as described in Table 2.
4. Re-apply drive power.
5. Observe the RXD LED flashing. This occurs while the parameters are being read from the drive stops when this step is complete.
6. Observe the TXD LED flashing. This occurs while the current parameter settings are being compared to the values stored in the option card EEPROM and stops when this step is complete.
7. Upon successful completion of this function, the TXD LED remains on and all other LEDs should be off if no differences exist. *If there are any differences, the ERROR LED will be flashing. Monitor U-11 is used to display the data which is different. The parameter number is displayed first, as '1xxx', where 'xxx' is the parameter number. The next value displayed is the value stored in the option card EEPROM. These values can be recorded and compared to the current drive settings. The list of differences is displayed repeatedly until power is removed.*
8. Remove drive power.
9. Reset switches S1 and S2 to their usual settings.
10. Attach the network connection.
11. Re-apply drive power.

7. Diagnostic LEDs

7.1 RXD

This LED is lit under the following conditions:

- While the drive is attempting to establish communication with the option card, the RXD, TXD, and FAULT LEDs blink in unison and “CALL” blinks on the digital operator. If this condition occurs, repeat the steps outlined in **Section 2.2, Drive Set-up**.
- During normal operation with the drive attached and configured on the network, this LED blinks anytime the drive receives a message addressed to it. Its blinking under these conditions indicates a “healthy” link between the drive and the network.
- During normal operation with the drive either unattached or unconfigured on the network, this LED blinks while the option card is communication with the drive. Its blinking under these conditions indicates a “healthy” link between the drive and the option card.
- During use of the parameter management functions, this LED blinks during the first phase of each function and is off upon completion (**See Section 6, Parameter Management Functions**).

7.2 TXD

This LED is lit under the following conditions:

- While the drive is attempting to establish communication with the option card, the RXD, TXD, and FAULT LEDs blink in unison and “CALL” blinks on the digital operator. If this condition occurs, repeat the steps outlined in **Section 2.2, Drive Set-up**.
- During normal operation, this LED blinks anytime the drive is responding to a message from the network. Its blinking indicates a “healthy” link between the drive and the network.
- During use of the parameter management functions, this LED blinks during the second phase of each function and remains lit upon completion (**See Section 6, Parameter Management Functions**).

7.3 FAULT

This LED is lit under the following conditions:

- While the drive is attempting to establish communication with the option card, the RXD, TXD, and FAULT LEDs blink in unison and “CALL” blinks on the digital operator. If this condition occurs, repeat the steps outlined in **Section 2.2, Drive Set-up**.
- During normal operation, this LED is lit if a cable loss is detected (**See Section 4.4,**

Cable Loss Behavior). Once communication is re-established, this LED should be off.

- During use of the parameter management functions, this LED blinks if there is data to be read on the digital operator (**See Section 6, Parameter Management Functions**).