Lakewood Automation
27911 Clemens Road Westlake, Ohio 44145

Tolomatic ICR to Proface AGP via CANOpen.

PURPOSE:

This document will show how to configure the Tolomatic ICR and the Proface AGP to be able to communicate over a CANOpen network. The Tech Connect will show how to read the current position and velocity, monitor the status bits, set the control bits and set a new commanded position and speed.

REQUIRED EQUIPMENT:

1. ICR20S BN02 SM457.2 LMI SV1P CPS CNC5 MP2 MY2 KY1
   Tolomatic ICR Plus with CanOpen.
2. AGP3300-T1-D24-CA1M Proface AGP with CanOpen.
3. S82K-05024 24VDC Power Supply for screen and IO

REQUIRED SOFTWARE:

1. GPProEx V2.6 Proface AGP Programming Software.
2. CME2 V5.3 Copley Controls ICR Programming Software.

REQUIRED CABLES:

1. CA3-USBCB-01 Pro-Face Programming Cable.
2. AGP to ICR CanOpen Cable (See Below for pinout)

FILES:

Tolomatic ICR to Proface AGP….. .doc	The file you are reading.
CopleyAmp.eds	CanOpen EDS file for the ICR.
Tolomatic ICR to Proface AGP….. .prx	Program file for the Proface AGP.
Tolomatic ICR to Proface AGP….. .ccx	Program and Config file for ICR.

HELPFUL MANUALS:

2100-4001 Tolomatic ICR User Guide
2100-4003 ICR CanOpen Programming Manual
GPProEx Device/PLC Connection Manual – CanOpen Slave Driver

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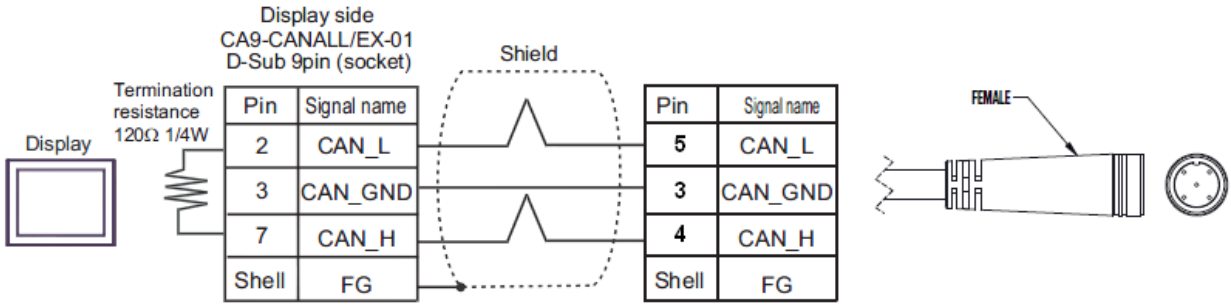
INSTRUCTIONS:

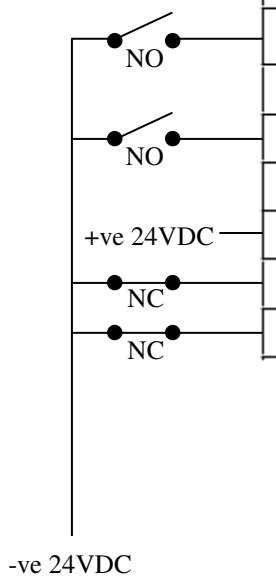
1. Make the following cable to go between the AGP and the ICR to communicate over CANOpen.



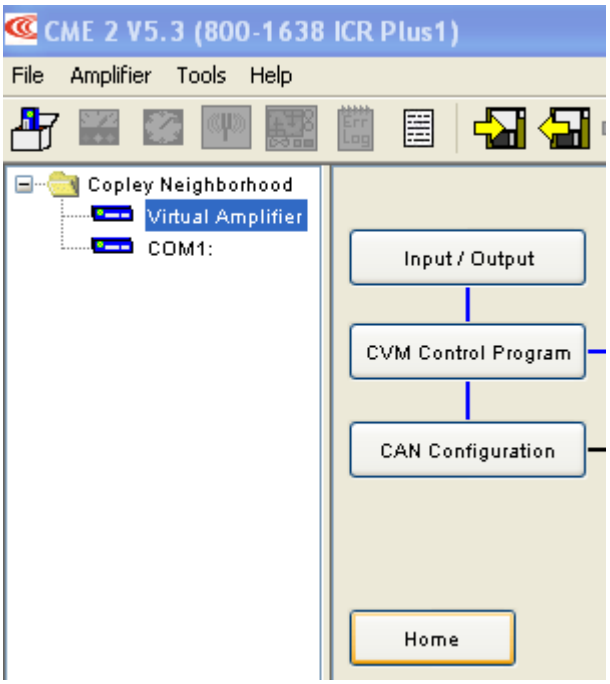
Please reference the following manuals for this cable configuration:
Page 3-4 of manual 2100-4001 Tolomatic ICR User Guide
Page 14 of manual GPProEx Device/PLC Connection Manual – CanOpen Slave Driver

2. Cable part number 3604-1640 is the IO Cable that plugs into the ICR. Wire up the following terminals.

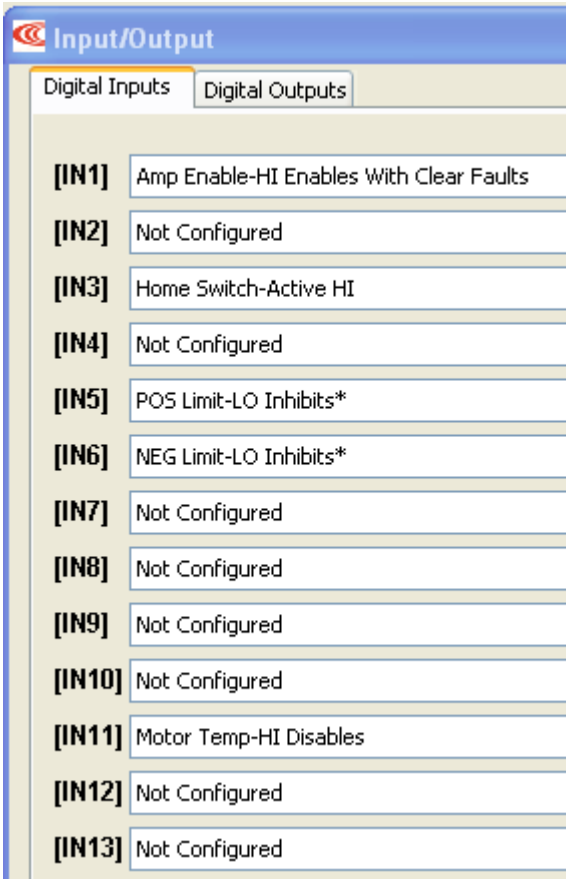
PIN NUMBERS				
STD.	IP65	DESCRIPTION		CABLE WIRE COLOR
1	A	RS232 RX		Red/Black/White
2	B	RS232 TX		Orange/Green
9	J	In 1	Amp Enable	Orange/Black
10	K	In 2		Red/White
11	L	In 3	Home Sw	Green/White
12	M	In 4		Blue/White
13	N	Input Common		White/Black/Red
14	P	In 6	End Of Travel Sw +ve	White/Red
15	R	In 5	End Of Travel Sw -ve	Orange/Red



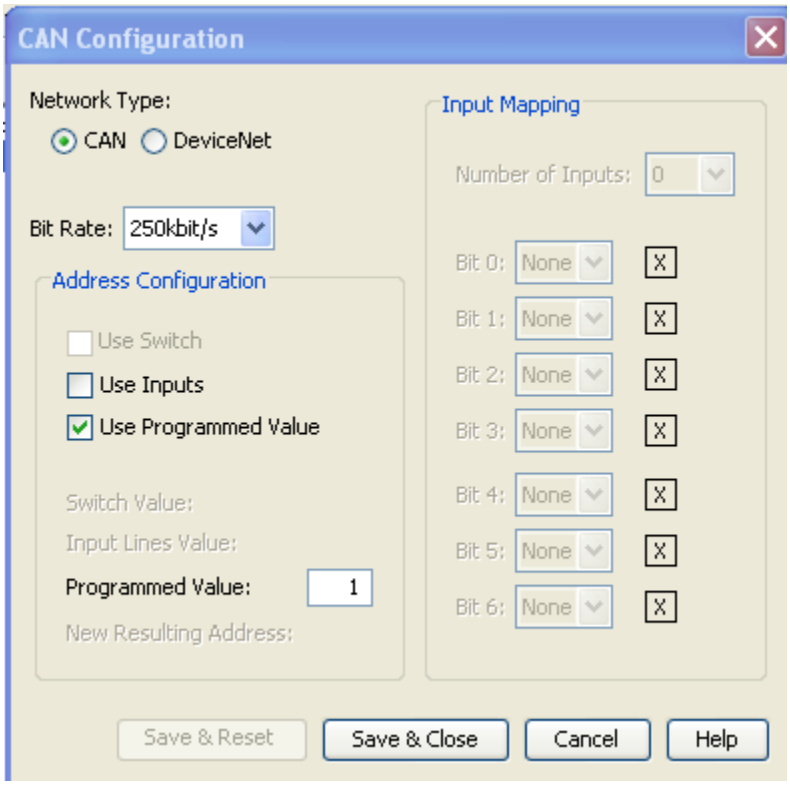
3. Make a cable from Pins 1 & 2 in the image above to communicate from the ICR to the PC. Power up the Tolomatic ICR. Start the CME2 software and connect to the unit. Click on the Input / Output button to configure the I/O.



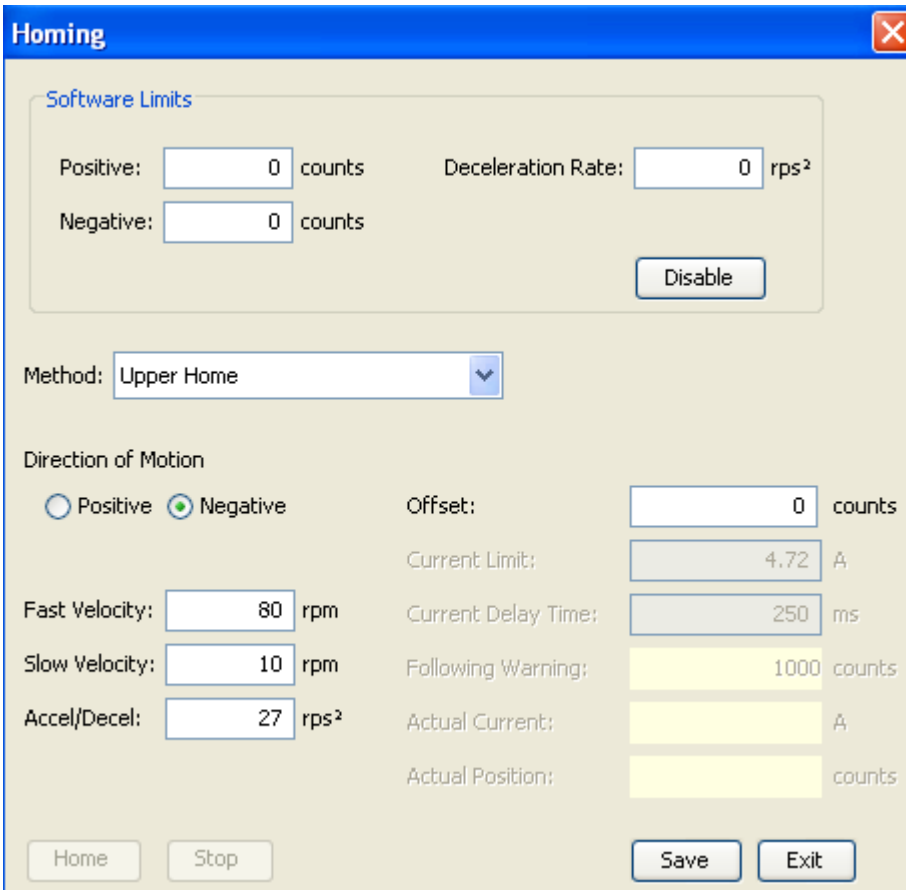
4. Select the following I/O.



5. Click on the CAN Configuration. Make the following settings. Click Save & Close.

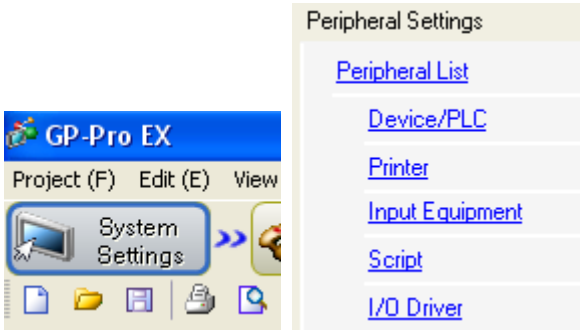


6. Click on the Home Button. Make the following settings. Click Save and then Exit.
   You can check that your settings are correct by pressing the home button on the bottom of this window. By doing so, the actuator should home and then stay at the home position. If you have a problem press the Stop button, make the desired changes and Home again. In this Tech Connect, all the homing parameters are set here and the AGP just tells the unit to home using these parameters.

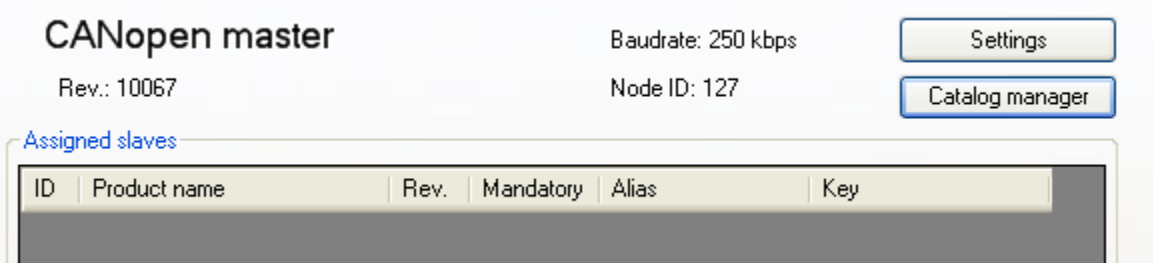


7. Click on the Icon to Save Amplifier working memory to flash.
8. Exit out of the CME2 software.
9. Open the GPProEx V2.6 Software and create a new project. Make the following selections and Click Next.

10. As we are using the CANOpen module built into the AGP we do not need to setup a communications driver, so click on the Communications Settings Button.
11. Click on the System Settings button and then select I/O Driver from the Peripheral List.

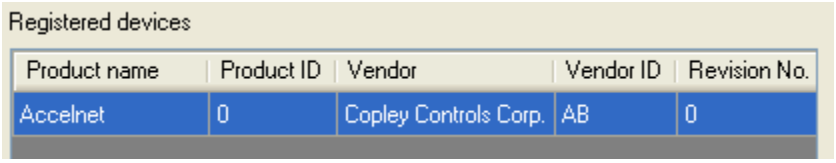


12. The CANOpen Master will open. Click on the Catalog manager button so we can load the EDS driver for the ICR amplifier.



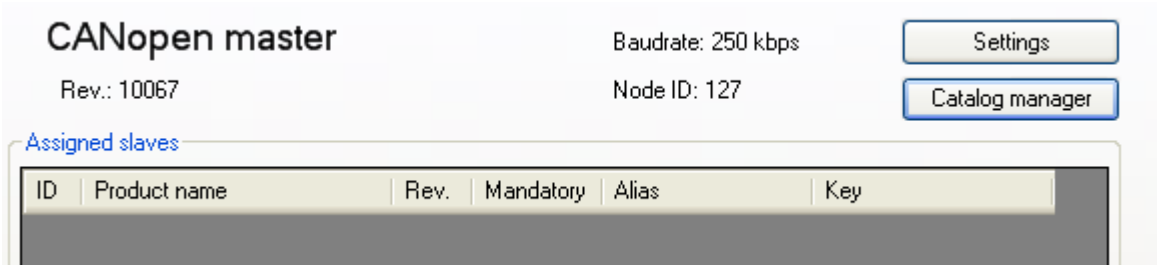
13. In the Device Operations area, click on the Import Button.

14. Navigate to the CopleyAmp.eds file provided with this Tech Connect and click Open. You should now see the following in the Registered devices.

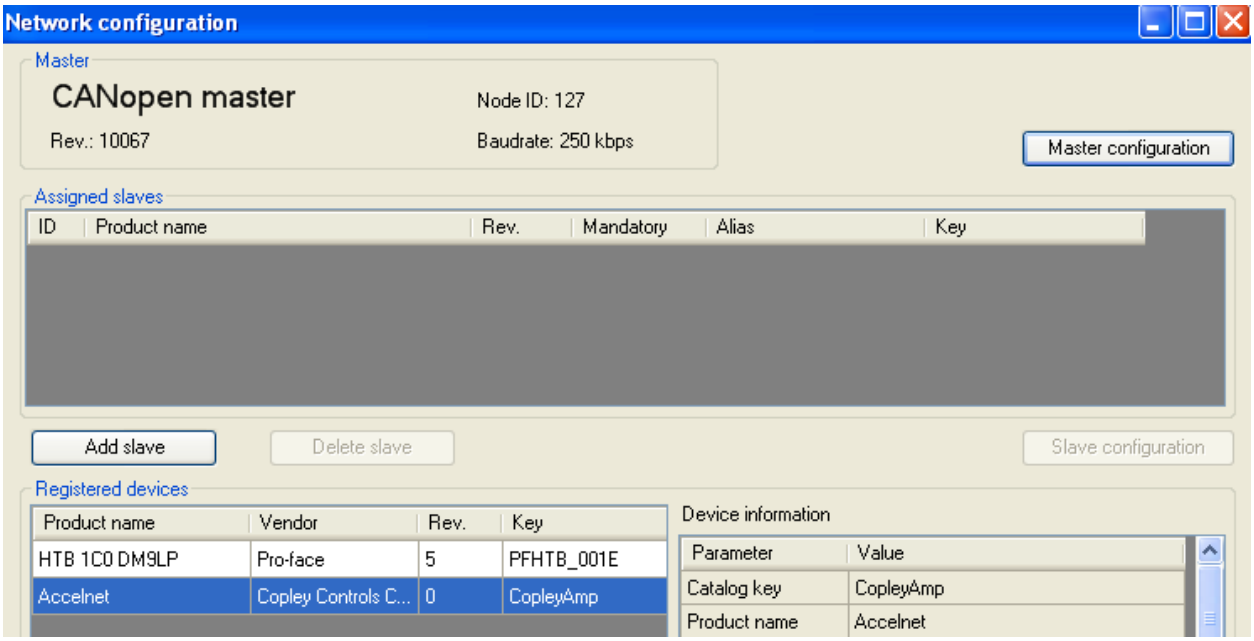


15. Click on the Close Button.

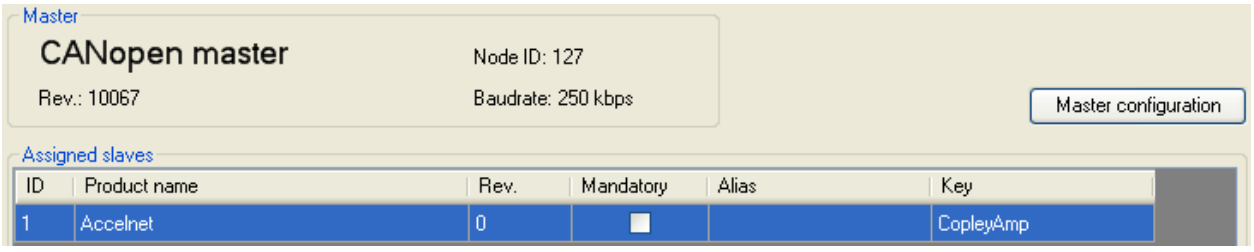
16. Click on the Settings button.



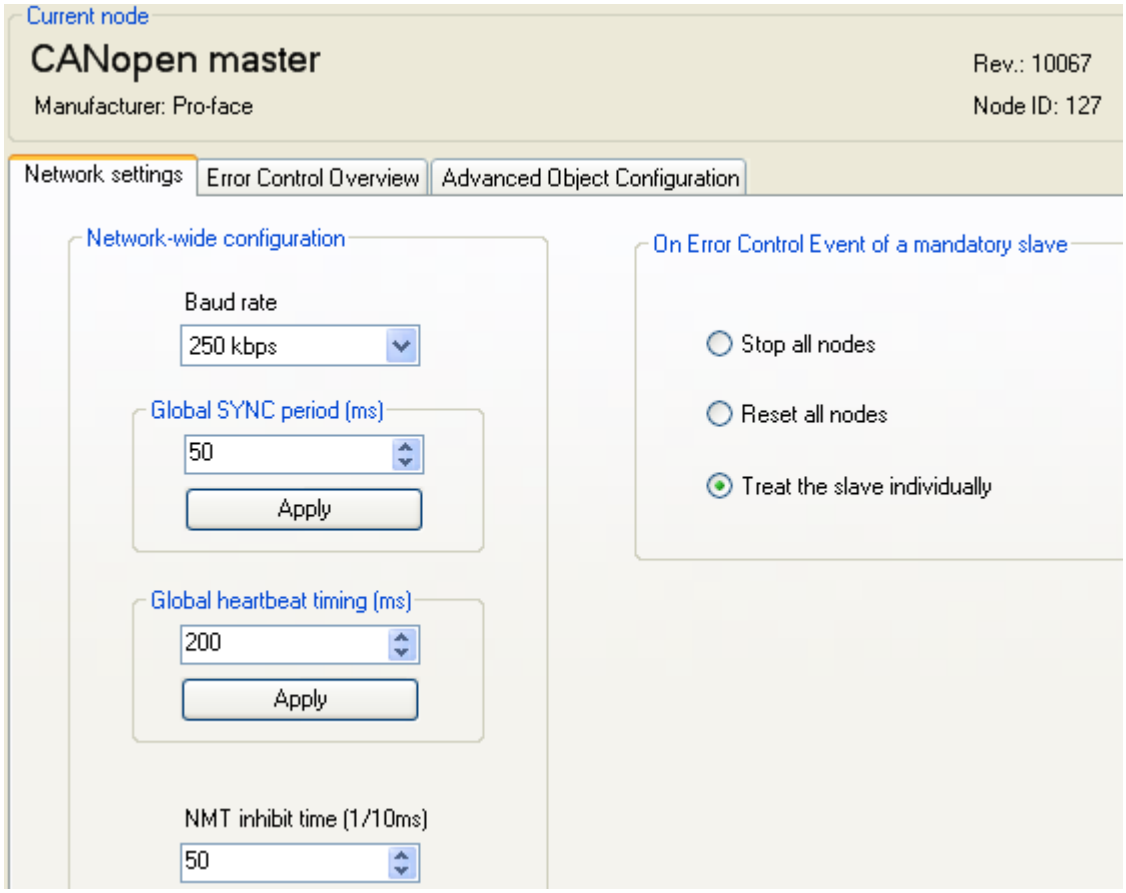
17. The Network Configuration will open.



18. Select the Copley Controls Amp and click on the Add Slave button. You may get an error about things being mapped twice. That is OK. Just click OK.



19. Click on the Master Configuration Button. Setup the following and click on OK.

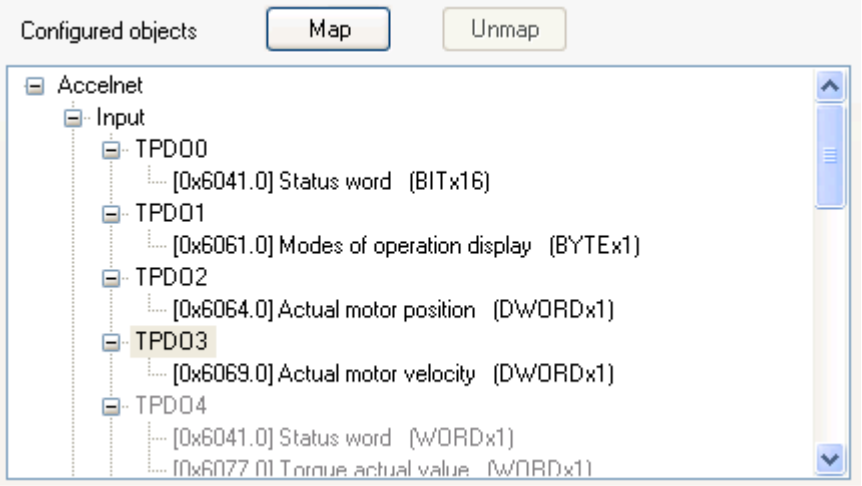


20. Click on the Slave Configuration Button. This area contains the mappings for this device.
21. The ICR Amplifier has many areas that can be mapped into the AGP. This is where they are found. If you scroll up and down, you can see all the available options.

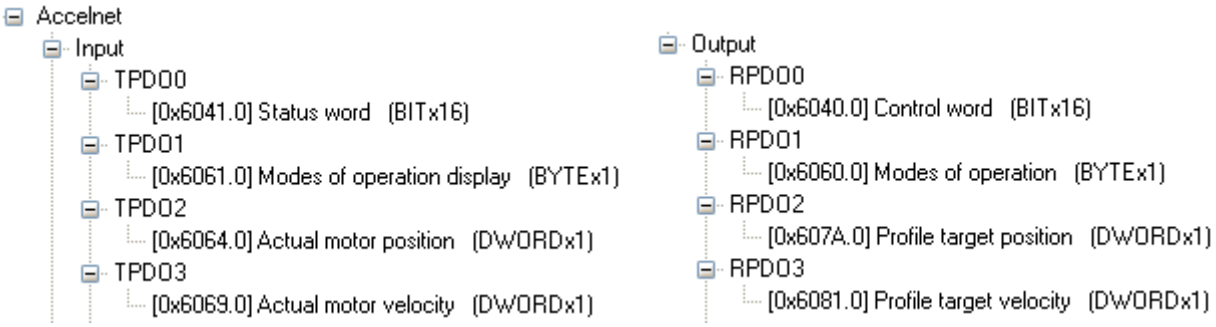
Available objects from device profile

Index	Parameter	Data type	Access
0x1001.0	Error Register	Unsigned8	read-only
0x1002.0	Amplifier event word	Unsigned32	read-only
0x1013.0	High resolution time stamp	Unsigned32	read-write
0x2010.0	PVT Buffer data	Unsigned64	read-write
0x2011.0	PVT buffer count	Unsigned16	read-only

22. The following area shows what you currently have mapped.



23. To change the mappings you need to select an item from the Available Objects, select where in the Configured Objects you want it to be mapped to and then click on the Map button. If you want to remove something from the mapped area, just select it and click on the UnMap button.
24. The AGP file that comes with this Tech Connect has the following mappings already setup.



25. For each TPDO and RPDO there are settings to the right which must be configured. These have already been done for this example.

26. Click OK and OK again to get back to the CanOpen Master page. On the far right side of the screen there is a link to the I/O Screen. Click on that link. We have already named each of the points we are going to use.

27. Now that we have the IO configured we can develop some screen to use the IO points. The AGP from this Tech Connect already has some screens ready to be used.
28. The Main Screen gives you an overview of what can be done.

29. At the top left and top right are the Current Position and Current Speed.
30. You need to Enable the Servo first and then Home the Servo. There are some lights to give you status.
31. Once homed, you can enter a Target Position and Speed and then select an Absolute Move or a Relative Move. Try a few of each.
32. There are also other screens and logic in the AGP that break down the operations even more.

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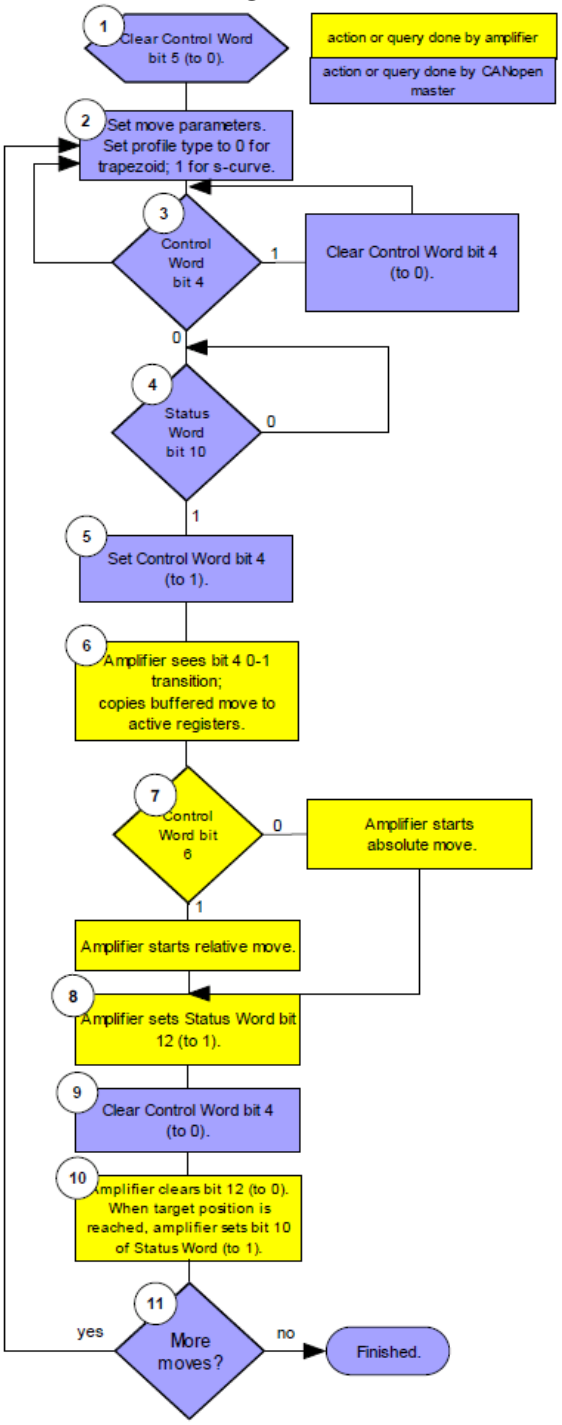
OPERATION SEQUENCE FOR A SERIES OF DESCRETE MOVE PROFILES:



This diagram illustrates how to implement a series of moves as a series of discrete profiles.

1. Control Word bit 5 is “change set immediately.” Clearing it tells the amplifier to treat a series of moves as a series of discrete profiles.

2. Move Parameters are described on page 108.

3. Control Word bit 4 is “new setpoint.” It needs to be 0 because the move is triggered by a 0->1 transition.

4. Status Word bit 10 is “target reached.” Value is 0 when move is in progress; 1 when move is finished.

5. Value of 1 indicates that valid data has been sent to amplifier and new move should begin.

6. Amplifier must detect 0-1 transition to begin move.

7. Control word bit 6: value 0 causes absolute move; value 1 causes relative move.

8. Status Word bit 13 is “setpoint acknowledge.” A value of 1 indicates the amplifier has received a setpoint and has started the move.

9. Control Word bit 4 is “new setpoint.” It needs to be 0 to allow the next move is triggered by a 0->1 transition. Also, the 1->0 transition causes the amplifier to clear bit 13.

10. Amplifier detects 0->1 transition of Control Word bit 4 and clears bit 13 in response. When the motor reaches the target position, the amplifier sets Status Word bit 10 (“target reached”) to 1.

11. CANopen master returns to step 2 if there are more moves to complete; otherwise, the series of moves is finished.

STATUS WORD BREAKDOWN:

STATUS WORD — INDEX 0X6041

Type	Access	Units	Range	Map PDO	Memory
Unsigned 16	RO	-	See *Description*, below.	Event	-

Description

This object identifies the current state of the amplifier and is bit-mapped as follows:

Bits	Description
0	Ready to switch on.
1	Switched on.
2	Operation Enabled. Set when the amplifier is enabled.
3	Fault. If set, a latched fault condition is present in the amplifier.
4	Voltage enabled. Set if the amplifier bus voltage is above the minimum necessary for normal operation.
5	Quick Stop. When clear, the amplifier is performing a quick stop.
6	Switch on disabled.
7	Warning. Set if a warning condition is present on the amplifier. Read the Manufacturer Status Register object (index 0x1002, p. 56) for details of what warning is bit indicates.
8	Set if the last trajectory was aborted rather then finishing normally.
9	Remote. Set when the amplifier is being controlled by the CANopen interface. When clear, the amplifier may be monitored through this interface, but some other input source is controlling it. Other input sources include the serial port, amplifier CVM program, analog reference input, digital command signals (i.e. PWM input or master controller), and internal function generator. The input source is controlled by the 'amplifier desired state' value, which is normally programmed by the CME-2 software. This setting can be manipulated through the CANopen interface through the Desired State object (index 0x2300, p. 60).
10	Target Reached. This bit is set when the amplifier is finished running a trajectory, and the Position Error (index 0x60F4, p. 116) has been within the Position Tracking Window (index 0x6067, p. 115) for the programmed time. The bit is not cleared until a new trajectory is started.
11	Internal Limit Active. This bit is set when one of the amplifier limits (current, voltage, velocity or position) is active. The specific bits from the Manufacturer Status Register (index 0x1002, p. 56) that cause this bit to be set can be customized by using the mask defined in the Limit Status Mask object (index 0x2184, p. 57).
12-13	The meanings of these bits are operation mode specific:

Bit	Profile Position Mode	Profile Velocity Mode	Profile Torque Mode	Homing Mode	Interpolated Position Mode
12	Setpoint acknowledge.	Speed = 0.	Reserved	Homing attained.	Interpolated pos. mode active.
13	Following error.	Maximum slippage error.	Reserved.	Homing error.	Reserved.

For information on operation modes, see Mode Of Operation (index 0x6060, p. 59).

14	Set when the amplifier is performing a move and cleared when the trajectory finishes. This bit is cleared immediately at the end of the move, not after the motor has settled into position.
15	Reserved.

CONTROL WORD BREAKDOWN:

CONTROL WORD — INDEX: 0x6040

Type	Access	Units	Range	Map PDO	Memory
Unsigned 16	RW	-	See *Description*, below.	EVENT	R

Description

This object is used to controls the state of the amplifier. It can be used to enable / disable the amplifier output, start, and abort moves in all operating modes, and clear fault conditions.

Control Word Bit Mapping

The value programmed into this object is bit-mapped as follows:

Bits	Description
0	Switch On. This bit must be set to enable the amplifier.
1	Enable Voltage. This bit must be set to enable the amplifier.
2	Quick Stop. If this bit is clear, then the amplifier is commanded to perform a quick stop.
3	Enable Operation. This bit must be set to enable the amplifier.
4-6	Operation mode specific. Descriptions appear in the sections that describe the various operating modes. Also see Mode Of Operation (index 0x6060, p. 59).
7	Reset Fault. A low-to-high transition of this bit makes the amplifier attempt to clear any latched fault condition.
8	Halt. If the bit is set, the amplifier will perform a halt.
9-15	Reserved for future use.

HALT OPERATION BREAKDOWN:

HALT OPTION CODE **INDEX 0x605D**

Type	Access	Units	Range	Map PDO	Memory
Integer 16	RW	-	See *Description*, below.	NO	R

Description

This object defines the behavior of the amplifier when a halt command is issued. The following values are defined.

Value	Description
0	Disable the amplifier's outputs
1	Slow down using the slow down ramp (i.e. the normal move deceleration value).
2	Slow down using the quick stop ramp.
3	Stop the move abruptly.

All other values will produce unspecified results and should not be used.

CHANGE MODE OF OPERATION BREAKDOWN:

MODE OF OPERATION — INDEX 0X6060

Type	Access	Units	Range	Map PDO	Memory
Integer 8	RW	-	See *Description*, below.	YES	R

Description

This object selects the amplifier's mode of operation. The modes of operation presently supported by this device are:

Mode	Description
1	Profile Position mode.
3	Profile Velocity mode.
4	Profile Torque mode.
6	Homing mode.
7	Interpolated Position mode

The amplifier will not accept other values.

Note that there may be some delay between setting the mode of operation and the amplifier assuming that mode. To read the active mode of operation, use object 0x6061.

DISPLAY MODE OF OPERATION BREAKDOWN:

MODE OF OPERATION DISPLAY — INDEX 0X6061

Type	Access	Units	Range	Map PDO	Memory
Integer 8	RO	-	See *Description*, below.	EVENT	-

Description

This object displays the current mode of operation.

PROFILE POSITION MODE CONTROL AND STATUS WORD BREAKDOWN:

Move-Related Control Word and Status Word Bit Settings

An amplifier's Control Word (index 0x6040) and Status Word (index 0x6041) play an important role in the initiation and control of point-to-point move sequences, as described below.

Object Name / Index	Bit #	Bit Name	Description/Comments
Control Word / 0x6040	4	new setpoint	The transition of bit 4 from 0 to 1 is what causes the amplifier to copy a set of move parameters from the buffer to the active register, thus starting the next move.
	5	change set immediately	Allows or prevents attempt to perform a series of moves as one continuous profile (change move parameters while move is in progress). Value = 0: Amplifier will ignore a 0 to 1 transition on bit 4 if there is currently a move in progress. Value = 1 and Motion Profile Type (index 0x6086, p. 178) = trapezoidal or velocity mode: Allow new move to begin immediately after bit 4 low-to-high transition. Value = 1 and Motion Profile Type is S-curve: Ignore update and continue move with old parameters.
	6	absolute/relative	Value = 0: Move is absolute (based on home position). Value = 1: Move is relative (based on current commanded position).
	8	halt	Value = 1: Interrupts the motion of the drive. Wait for release to continue.
Status Word / 0x6041	10	target reached	Amplifier sets bit 10 to 1 when target position has been reached. Amplifier clears bit 10 to zero when new target is received. If quick stop option code (p. 58) is 5, 6, 7, or 8, this bit is set when the quick stop operation is finished and the drive is halted. Bit 10 is also set when a Halt occurs.
	12	setpoint acknowledge	Set by the amplifier when Control Word bit 4 goes from 0 to 1. Cleared when Control Word bit 4 is cleared. An invalid transition on Control Word bit 4 will not cause this bit to be set. Invalid transitions include those made while drive is in motion and in S-curve mode, or made while drive in motion with Control Word bit 5 not set.