CiA® 402-CANopen QuickStart

This QuickStart sheet is intended to allow you to quickly get a QuickSilver drive up and operating under the CiA 402 protocol.

Setting options in the initialization file

Step 1: Get the file.

Open the CiA 402 Initializaition xxxxx.qcp initialization file.

Step 2: Select the program to modify

In program List, select program 0 “Main Init and User Customization”

Step 3: enable default motion parameters

Disable line 78 to provide default homing and moving velocities and accelerations. Line 78 is disabled by selecting line 78 and then right clicking and selecting “Disable”. The line should show be greyed out.

You can start with the defaults, or modify them as desired. Line 78 is provided to conform to the standard which has the motion defaults initialized to zero at initial configuration.

Step 4: optional – slow down the state update rates
If you are using a CAN monitoring program with a PC to first test out the protocol, you may want to reduce the update rates by increasing the update time for the TPDO communications. This will slow the data crossing your screen. This is done by selecting program 1 “Standard CAN configuration”, and modifying the data in line 54, and line 69 from 100 to 500 (update every 500 milliseconds).

Save the initialization file under a new name, and run the Initialization Wizard using the new file name. (Note, if the unit has already been initialized for the motor type and cable length, then a download/restart is sufficient. It is not necessary to use the initialization wizard.)

Configuring Hardware

Hardware: Make sure the CAN termination is in place. The QCI-D2-IG8 provides a termination via a jumper on the front header. The QCI-D2-IGB provides the termination by jumpering TERM to CAN_L. Other units will need an external ½ w 120 ohm resistor between CAN_H and CAN_L.

COB-ID from NODE-ID

The default initialization routine sets the node ID to 16, which is 10h (hexadecimal 10). The various default COB-ID addresses are calculated as a base COB-ID value plus the Node Id.

For example the COB-ID associated with RPDO1 defaults to 200h + Node ID, which would be 210 for the default example. The nodes referenced below will be based on a node ID of 16. You will need to adjust the COB-ID values for other Node-ID values.

Data format

CANopen uses a little-endian format for sending data. This means the data is sent least significant byte to most significant byte within each field.

Initializing the state machine

The power is not applied to the motor until the CiA-402 System State Machine has reached “Switched ON” and will not accept motion requests until it has reached “Operation Enabled” state. At power up, it starts in state 0 and after initialization has completed, it should be in the “Switch On Disabled” state. The following steps will bring you to Operation Enabled.

Step 1: Wait for the Status word to reach 0670h – “Not Ready to Switch On” (this will be transmitted via TPDO 1 with default COB-ID of 190 for our example unit ID=16.

Step 2: Transmit Command word to RPDO1 of the unit using its default COB-ID of 210h
The initial Command word should be "Shutdown" 0006h (remember the reversed byte order, so the first byte will be 06 and the second byte will be 00), and the DLC must match the number of bytes maped, in this case 2.

Step 3: Wait for the Status word to indicate “Switch on Disabled 0631h

Step 4 Transmit Command word “Switch On” via RPDO1 COB-ID=210h sending data 0007h

Step 3: Wait for the Status word to transition to “Switched on” 0633h

Step 4: Transmit Command word “Operation Enabled” via RPDO1 COB-ID=210h sending data 000Fh

Step 5: Wait for Status word to transition to “Operation Enabled” 0637h

At this point the motor will be energized. No other motions are allowed until the unit has been homed.

Homing

There are many choices for homing, including just taking the present position as the home. In this example we will use home to index pulse, homing method 34 (22h).

Step 1: Set the Homing Method and Mode of operation: RPDO4, with a default COB-ID of 510h is mapped three objects: Command Word (6040h – 16 bits), Homing Method (6098h – 8 bits), and Mode of Operation (6060h – 8 bits). These objects are configured by sending a frame with COB-ID of 510h, and Data of 000Fh (Command Word), 22h (Homing Method), 06h (Mode of Operation = homing).

Step 2: Wait for Mode of Operation Display to show 06h – unit is ready to be homed. TPDO2 is mapped to transmit STATUS (6041h – 16 bits) and Mode of Operation Display (6061h – 8 bit). TPDO2 uses COB-ID 290h.

Step 3: Send "Start Homing" signal by transitioning Command word Bit 4 from 0 to 1. This is done by transmitting 001Fh via COB-ID 210h. The motor should move (may be small motion if near index).

Step 4: Wait until Homing Completed (Bit 12 = 1). Verify Status Bit 13 =0 (no homing error).

Step 5: Clear the "Start Homing" signal. Transmit 000Fh via COB-ID 210

Moving using Position Profile (PP) mode

Step 1: Change modes to Position Profile. This is selected via Mode of Operation = 01
Send Frame to RPDO4 via COB-ID of 510h, and Data of 000Fh (Command Word), 22h (Homing Method), 01h (Mode of Operation = position profile - pp). Note that the Homing method will be ignored until the next homing request.

Step 2: Wait for the Mode of Operation Display to change to 01 (pp mode).

Step 3: Send the Control word (16 bits) and Target position (32 bits) to RPDO2 COB-ID 210h. This will need a DLC of 6. The data should be 000Fh, and desired new position. 40,000 counts would be 0000 9C40h. Remember this is sent as 0F, 00, 40, 9C, 00, 00 due to little-endian format.

Step 4: Set "Latch new Setpoint" via the Command word. Using RPDO1, COB-ID 210h, transmit a Command word of 001Fh (transition bit 4 from 0 to 1).

Step 5: Wait for Status word Bit 12 to acknowledge the set point (Will go to 1).

Step 6: Clear "Latch new Setpoint" via the Command word. Using RPDO, COB-ID 210h, transmit a Command word of 000Fh.

Step 7: Wait for Status word Bit 12 to clear the acknowledge (Will go to 0). This means the position profile move is ready for a new set point.

Step 8: repeat steps 3 through 7 changing the Target position as desired.

Note that other bits in the Command word may be used to modify the operation of the Position Profile operation. Bit 5 will cause the new setpoint to override the existing motion if set high. Bit 6 selects absolute (0) or relative (1) motion. Bit 8 will cause the motion to halt (until cleared – which will resume the motion, or until mode has been changed. Bit 9 determines whether, if a set point is pending, the previous motion should stop (0) or change set point parameters (position, acceleration, velocity) when the current setpoint has been reached. See QCI-AN060 for more details. Note that the system architect may choose to use PDO or SDO operations to run and configure the system. SDOs will be needed to modify parameters that have not been mapped. If you choose to use all SDO operations and will not be using PDO data to control the

system or to monitor the system, you should disable the unwanted RPDOs (prevent unwanted data from possibly being captured) and TPDOs (to prevent unused data from being transmitted that will consume some of the bus bandwidth).