



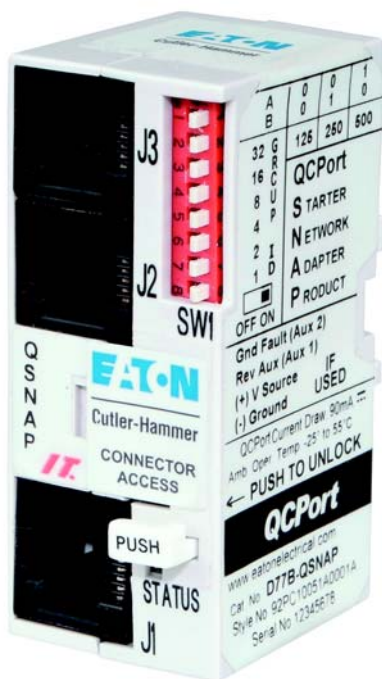
Cutler-Hammer

Intelligent Technologies

QCPort Starter Network Adapter D77B-QSNAP

Installation and User Manual

June 2005



Part Numbers

D77B-QSNAP-X1

D77B-QSNAP-X2

D77B-QSNAP-X3

D77B-QSNAP-X4

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Product Overview

Description

Cutler-Hammer Intelligent Technologies (IT.) D77B-QSNAP by Eaton Electrical is the result of a substantive engineering and marketing effort, involving extensive customer input. This product has greatly increased functionality of the IT. Electromechanical Starter with the addition of enhanced features. This front-mount device is a single QCPort node providing control and monitoring of an IT. Electromechanical Starter application.

The D77B-QSNAP provides a communication interface to the following IT. Electromechanical Starters.

Table 1: D77B-QSNAP Electromechanical Starter Connectivity Table

IEC E101, FVNR E501, FVR	NEMA N101, FVNR N501, FVR	Frame Width
B	00	45 mm
	0	
C	1	54 mm
D	2	76 mm
E	3	105 mm
	4	
F	5	140 mm

Table 2: D77B-QSNAP S75x Connectivity Table

S75x Soft Start
All V1.04 and Later

This manual specifically addresses the QCPort Starter Network Adapter Product (D77B-QSNAP).

For further information on the IT. family of devices, visit our Web site at: www.eatonelectrical.com

Notice

The D77B-QSNAP can only be applied with the IT. family of starters.

Features and Benefits

The **IT.** D77B-QSNAP includes the following significant features:

- Communication to QCPort.
- Control of non-reversing and reversing **IT.** Starters and S75x Soft Start.
- Monitoring of non-reversing and reversing **IT.** Starters and S75x Soft Start.
- Easy, direct mounting to the front of **IT.** Starters and S75x Soft Start.
- Optional ground fault detector input.
- No special software application required for normal setup. For extended setup, CH Studio provides configuration assistance.
- Over and under current warning levels that are user-settable.
- Auxiliary field inputs (2 points).
- HAND/OFF/AUTO option using the D77B-HOA8 HOA adapter.
- Complete configuration of I/O to fit the application requirements.
- Easy to install; no special tools required.
- Can field upgrade **IT.** Starters to communications using QSNAP.
- LED indication of faults and operational behavior.

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Safety

The following safety statements relate to the installation, setup and operation of the Cutler-Hammer *IT.* D77B-QSNAP and Starter from Eaton Electrical.

Notice

Make sure you read and understand the installation procedures in this manual **before** you attempt to operate or set up the equipment.



WARNING

Use this instruction manual for proper installation, setup, and operation of the *IT.* D77B-QSNAP. Improperly installing and maintaining this product can result in serious personal injury or property damage. Before attempting installation, setup or operation, read and understand this entire manual.



WARNING

Hazardous voltage can cause electric shock and burns. Always disconnect power before proceeding with any work on this product



WARNING

Only apply 24V DC to the QSNAP power terminals. Use of any other voltage may result in personal injury, property damage and damage to the *IT.* D77B-QSNAP.



WARNING

To provide continued protection against fire or shock hazard, the *IT.* D77B-QSNAP must be replaced if it becomes inoperative.



WARNING

Unplug the D77B-QSNAP from QCPort prior to mounting it to another *IT.* Starter.

Environmental Ratings

The following environmental ratings apply to the D77B-QSNAP.

Table 3: Environmental Ratings

Category	Description	Specification
Transportation/ Storage	Temperature	-50°C to 80°C [-58°F to 176°F]
	Humidity	5 – 95% non-condensing
Operating	Temperature	-25°C to 55°C [-13°F to 131°F]
	Humidity	5 – 95% non-condensing
	Altitude	Above 2000 meters [6600 feet] consult factory
	Shock (IEC 68-2-27)	15G in any direction for 11 milliseconds
	Vibration (IEC 68-2-6)	10 – 150 Hz, 5G, 0.7 mm maximum peak-to-peak

Approvals/Certifications

The following approvals and certifications apply to the D77B-QSNAP.

Table 4: Approvals/Certifications

Standard	Approval/Certificate
Electrical/EMC	
ESD Immunity (IEC 61000-4-2)	+/- 8kV air, +/- 4kV contact
Radiated Immunity (IEC 61000-4-3)	10V/m 80-1000 MHz, 80% amplitude modulation @ 1kHz
Fast Transient (IEC 61000-4-4)	+/- 2kV supply and control +/- 1kV communications
Surge (IEC 61000-4-5)	+/- 1kV line-to-line +/- 2kV line-to-ground
RF Conducted (IEC 61000-4-6)	10V, 0.15 – 80MHz
Magnetic Field (IEC 61000-4-8)	30 A/m, 50Hz
Other Standards	
Ingress Protection Code	IP20
Radiated and Conducted Emissions	EN55011 Class A
Agency Certifications	cULus by UL 508 CSA C22.2 No. 14 CE (Low Voltage Directive, EMC Directive)

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Catalog Numbering System

The D77B-QSNAP is ordered as an assembly, the assembly includes all components for normal operation.

Table 5: Catalog Numbers

Description	Catalog Number
D77B-QSNAP Assembly of terminal adapter, jumper and D77B-QSNAP for FVNR applications	D77B-QSNAP-X1
D77B-QSNAP Assembly of terminal adapter, jumper, D77B-QSNAP and second contactor sensor for FVR applications	D77B-QSNAP-X2
D77B-QSNAP Assembly of HOA adapter, jumper and D77B-QSNAP for FVNR applications	D77B-QSNAP-X3
D77B-QSNAP Assembly of HOA adapter, jumper, D77B-QSNAP and second contactor sensor for FVR applications	D77B-QSNAP-X4
Required QSNAP Adapter Kit for the 140 mm (Size 5 and F) Starter	D77B-140A
Input auxiliary for D77B-QSNAP	D77B-AC1
Hands Off Auto Adapter for SNAP family	D77B-HOA8

Physical Features

Physical Description

Figure 1 illustrates the front and back of the IT. D77B-QSNAP and its various dimensions.

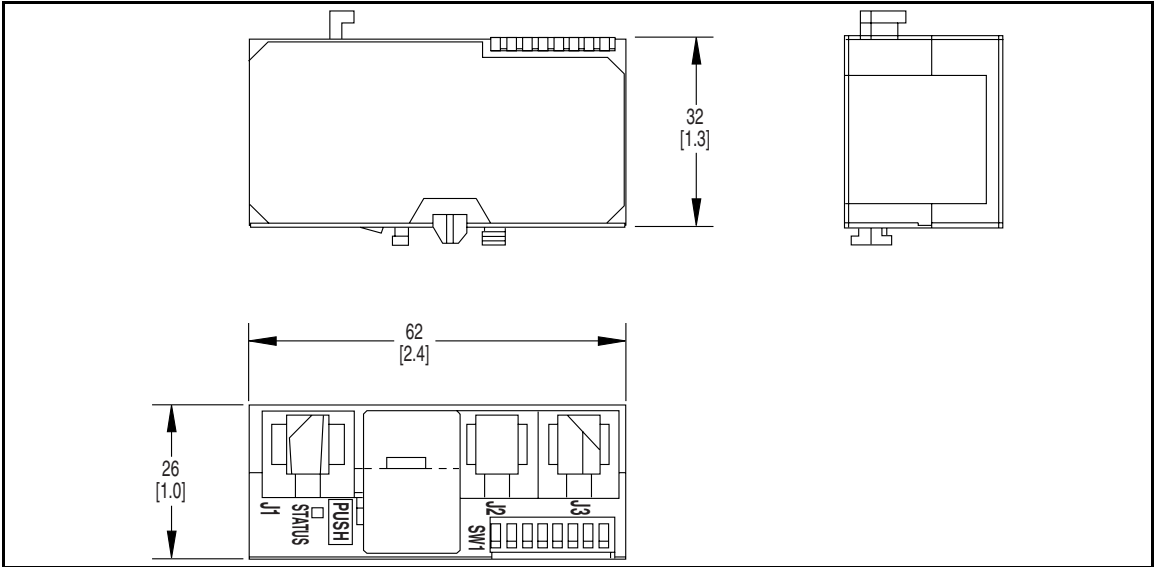


Figure 1: D77B-QSNAP Features and Dimensions, mm [in]

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Power Source

The *IT.* D77B-QSNAP is designed for use with 24V DC power. The power for the D77B-QSNAP comes from QCPort and monitors power from the *IT.* starter to detect loss of power on the *IT.* starter (E-Stop).

You must connect the power for the *IT.* Starter to the Starter Terminal Adapter.

Table 6: Power Requirements

Current Source	Load
From QCPort	90 mA

When choosing a power supply for the starter(s), size it for the load of the starter(s) and the D77B-QSNAP using the appropriate *IT.* contactor and starter user manual.

You must connect the power for the Cutler-Hammer *IT.* Starter to the *IT.* Starter terminal, as illustrated in **Figure 2.**

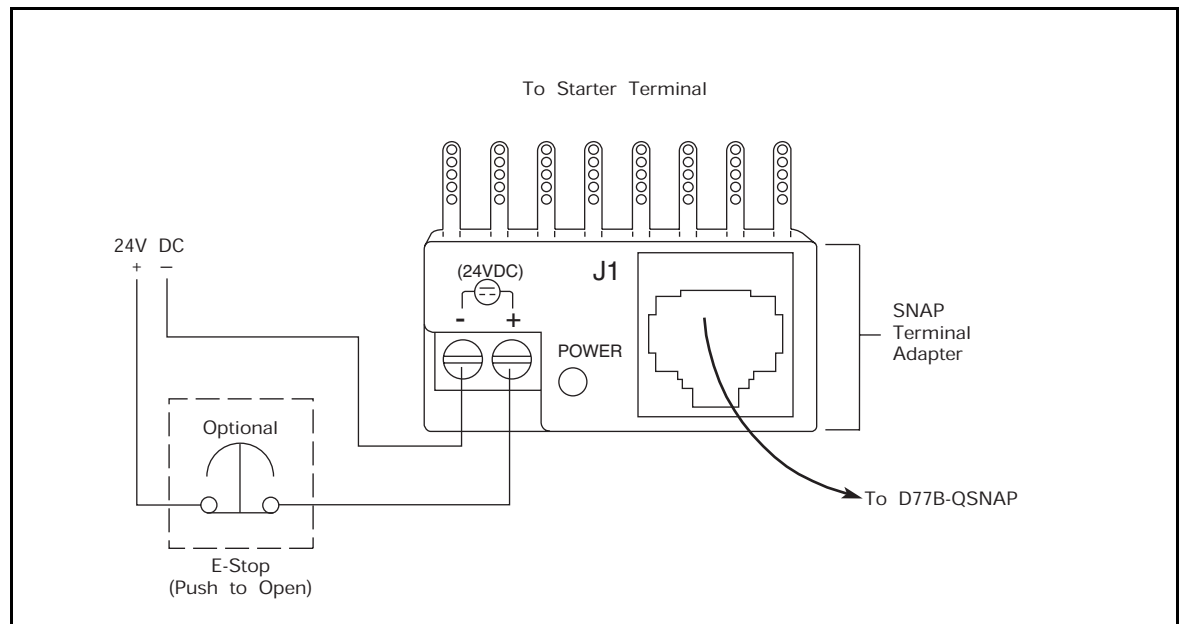


Figure 2: Starter Terminal Adapter Connection



CAUTION

Only apply 24V DC to the D77B-QSNAP. Use of any other voltage may result in personal injury, property damage and damage to the D77B-QSNAP.

Configuration

Offline Configuration Start

This section is designed to aide in choosing components, modifying the I/O and setting up any parameters special to the application for an offline project. Start by configuring the system offline using CH Studio Component Manger. If the system already exists and you can connect to it, then skip this step and go to the Online Configuration section.

Start CH Studio Component Manager and create a new project by using the File/New option from the pull down menu, or by selecting the New button on the toolbar. At this time, name the project.

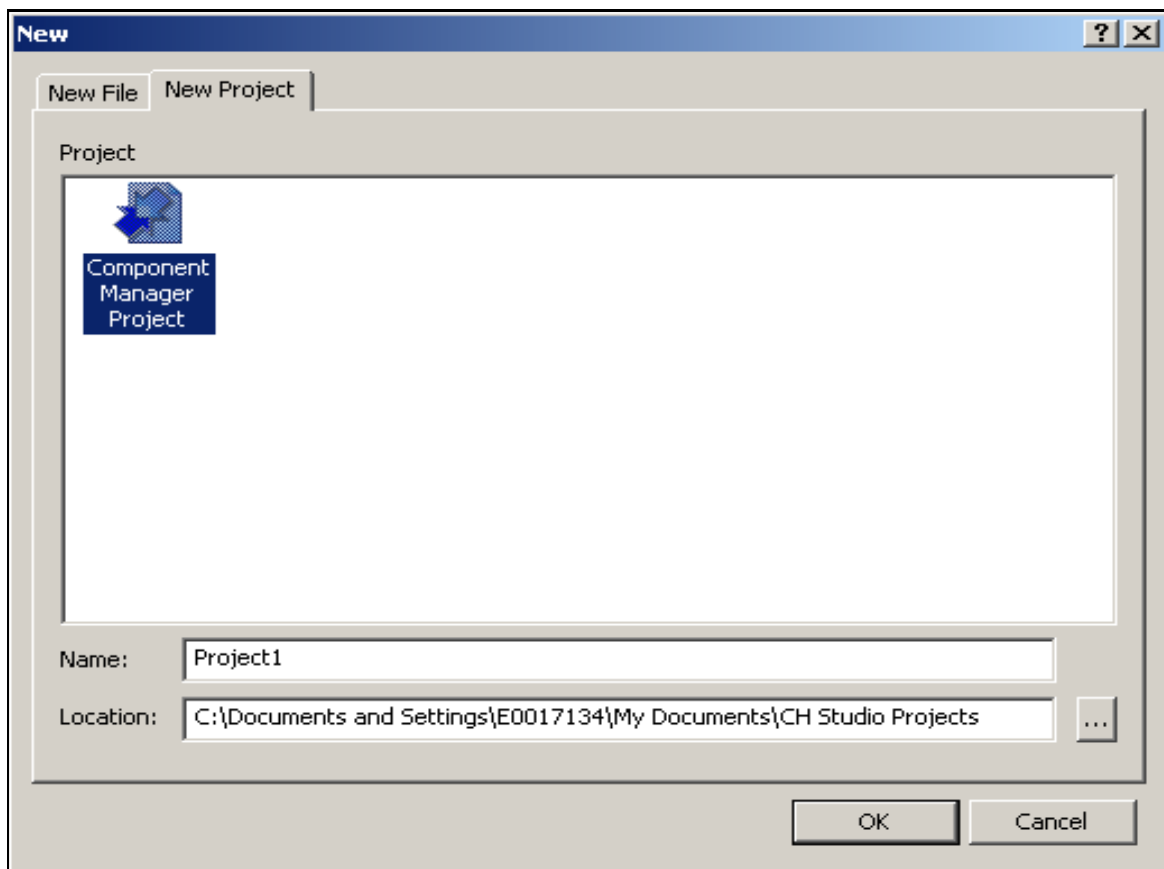


Figure 3: New Project Window

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Add Device

For this example a DeviceNet adapter (D77D-DNA) was used.

1. Once you have created the project, add the devices that compose the system. Do this by using the Tasks/ Add Device from the pull down menu, or by right clicking on the explorer window and choosing Add Device.
2. Select the D77D-DNA by Eaton/Cutler-Hammer. This device is the DeviceNet to QCPort adapter.
3. Choose Add and the D77D-DNA is placed on the Desktop.
4. Close the Add Device window at this time.

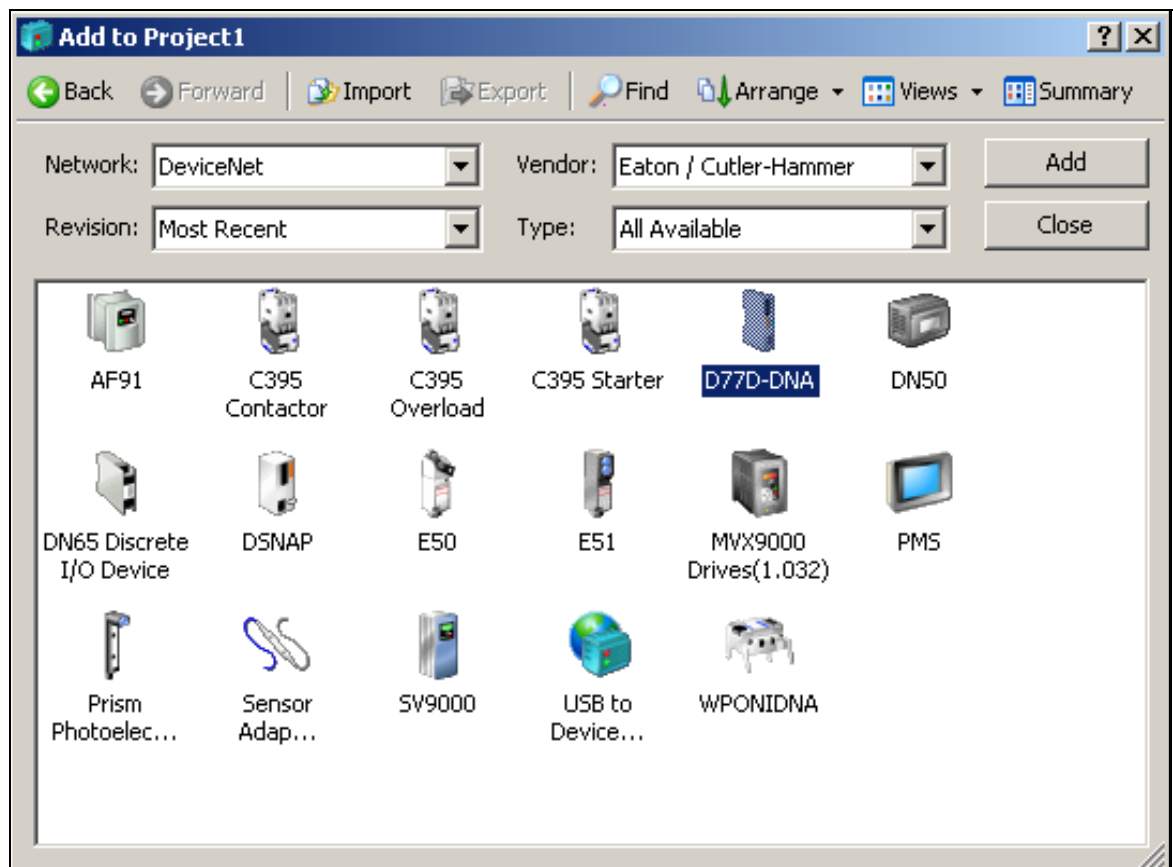
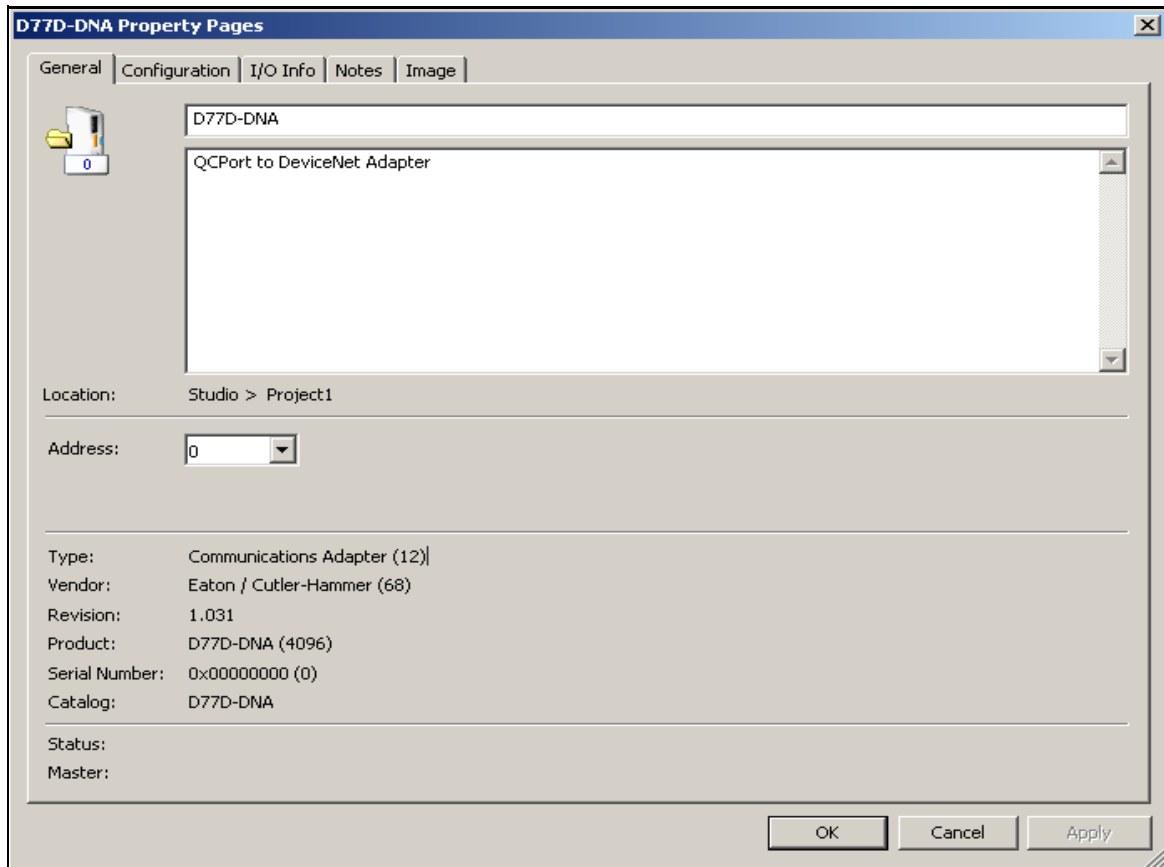


Figure 4: Add Device Window

D77D-DNA Property Page

1. Perform a right mouse click on the D77D-DNA and choose Properties. You can view/change the MAC ID and view the I/O data. At this time there is no I/O data since there are no QCPort devices added to the D77D-DNA.
2. Exit the Property window after setting the MAC ID.

**Figure 5: Property Page for D77D-DNA**

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Channel A Devices

1. Exit the Property Page for the D77D-DNA and double-click the D77D-DNA. There are two folders, a Channel A and a Channel B.
2. Double-click on Channel A.
3. Choose Add Device again and add a D77B-QSNAP. To add multiple D77B-QSNAPs, click the Add button multiple times. For this example, the panel has 5 D77B-QSNAP units in it. If there are multiple D77B-QSNAP units that require parameter modification, and are all identical to one another, you only need to add one D77B-QSNAP; then move on to the next step.

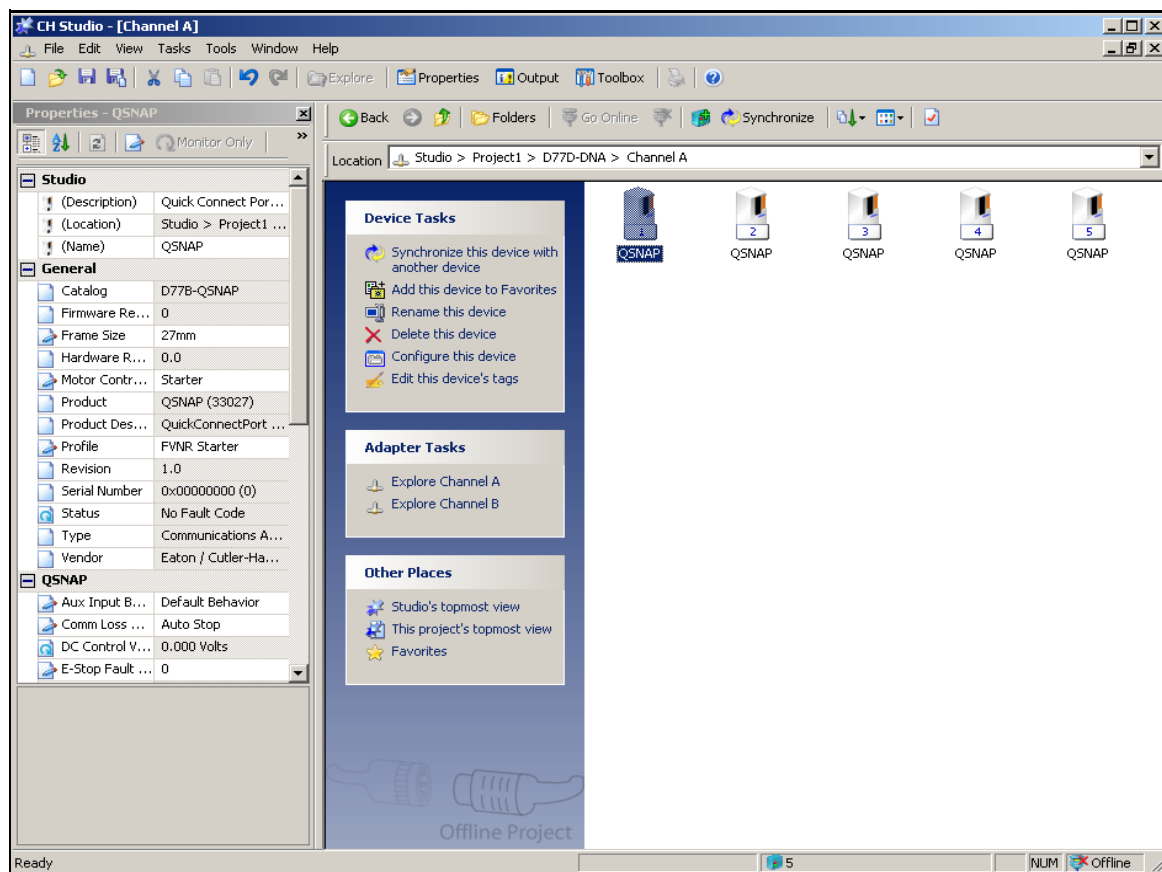


Figure 6: Channel A Devices

D77B-QSNAP Property Page

To display the Property Page for the D77B-QSNAP, double-click a D77B-QSNAP. On the Property Page are choices to enable/disable features and to choose I/O data.

Note that each D77B-QSNAP has an address associated with it. It is important that each D77B-QSNAP (QCPort device) has a unique address.

D77B-QSNAP Configuration Page

An external ground fault module is required to sense a ground fault using a D77B-QSNAP.

1. Check the Enable Ground Fault Trip.
2. Choose the duration (how long the ground fault must be active prior to trip).
3. Choose Inhibit Delay (when to start looking for a ground fault after a start). This is also the where you enable and set the Underload and Over Current warning levels.
4. The dip switch labeled GF on the D77B-QSNAP will need to be enabled (set to ON) to enable the ground fault trip behavior.

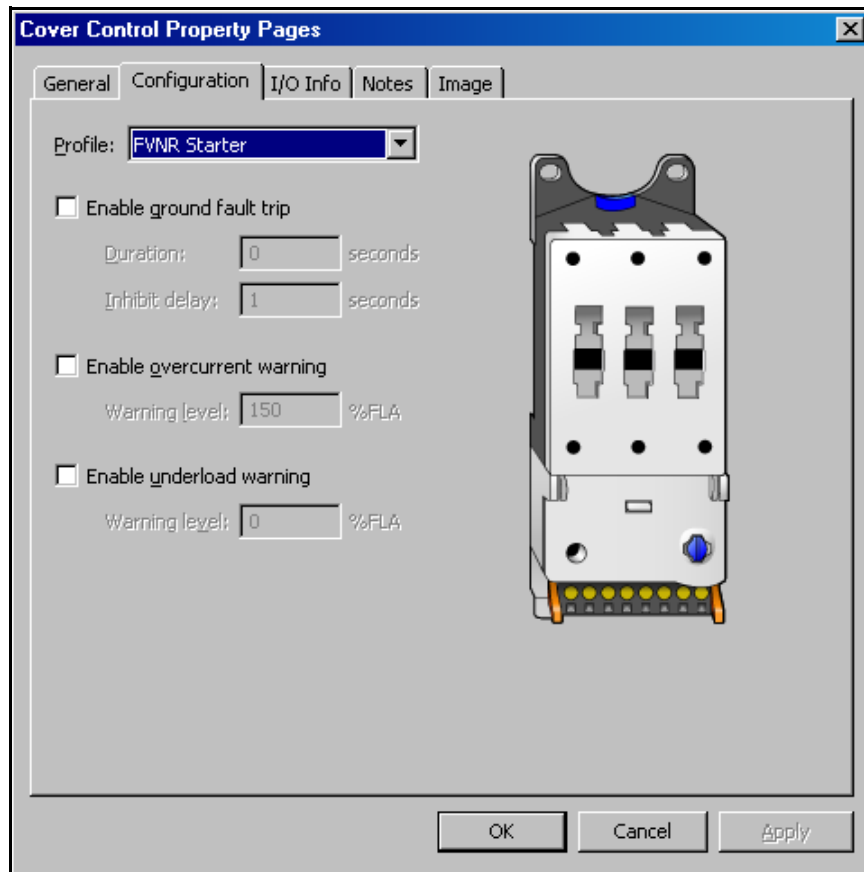
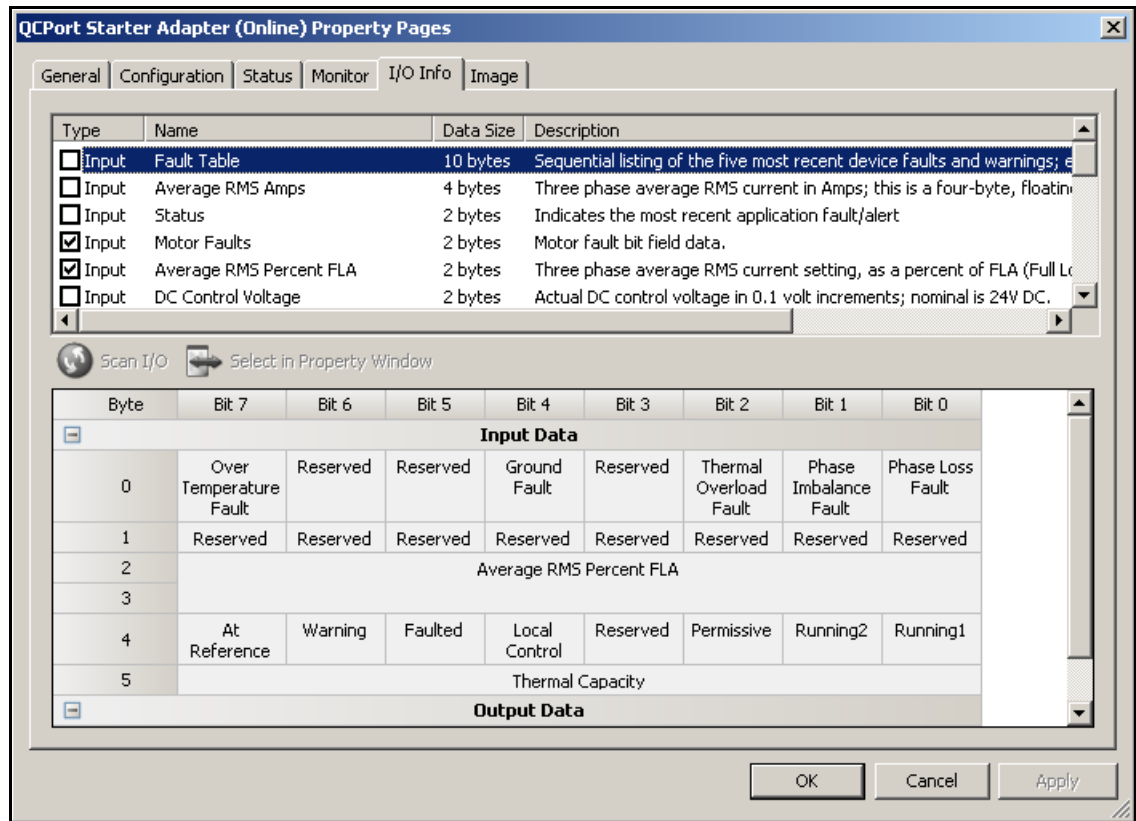


Figure 7: Configuration Properties

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D77B-QSNAP I/O Info Page

The I/O Info tab allows you to configure the I/O data for the application. The default I/O configuration is displayed on this tab, by selecting and deselecting the type of data, you can change the I/O to meet the application requirements.

**Figure 8: I/O Properties**

After you have completed all changes, choose the Apply button. Move to the next D77B-QSNAP and perform the process all over again. If all the D77B-QSNAP units require the same configuration:

1. Select the modified D77B-QSNAP and choose copy.
2. Paste as many D77B-QSNAPs as required on the explorer window.
3. Edit each D77B-QSNAP (double click on each D77B-QSNAP) to assign a unique address.
4. Save the project and continue to the Online Configuration section.

Performing an Online Configuration

If the network adapter is not installed, refer to the CH Studio Component Manager help to aide in the installation. The installation directions are in the shipping container with the registration form and the CH Studio CD.

Go Online

Connect the DeviceNet wiring to the network adapter and note the baud rate of the devices on the DeviceNet network. You must configure all devices on a DeviceNet network for the same baud rate; the default for all DeviceNet products is 125K. To change the baud rate for the network adapter, open the Property Page (right mouse click and choose Properties) and change the baud rate.

Double-click the DeviceNet icon and choose Go Online. The CH Studio Component Manager goes online and displays the DeviceNet devices on the DeviceNet network. To access the QCPort devices connected to at D77D-DNA, double-click its icon, then double-click the Channel A icon. All QCPort devices for Channel A that are in the D77D-DNA scan list are displayed. If the D77D-DNA was not configured properly, there will be no D77B-QSNAP units under the Channel A screen. If the D77D-DNA was configured properly, each D77B-QSNAP is represented on the explorer window. Verify from the job documentation that each D77B-QSNAP is represented on the explorer window. If any D77B-QSNAP units are missing from the explorer window, but are physically present in the panel, refer to the **Troubleshooting** section of this manual.

If the D77D-DNA is not configured, perform an Auto Configuration:

1. Right-click on the D77D-DNA.
2. Choose Reset.
3. Rebuild D77D-DNA device list and I/O mapping. This instructs the D77D-DNA to find all the D77B-QSNAP units and build a scan list to represent them.

After doing this, all the D77B-QSNAP units are displayed in the explorer window under Channel A. If any of the D77B-QSNAP units are not displayed, refer to the **Troubleshooting** section of this manual.

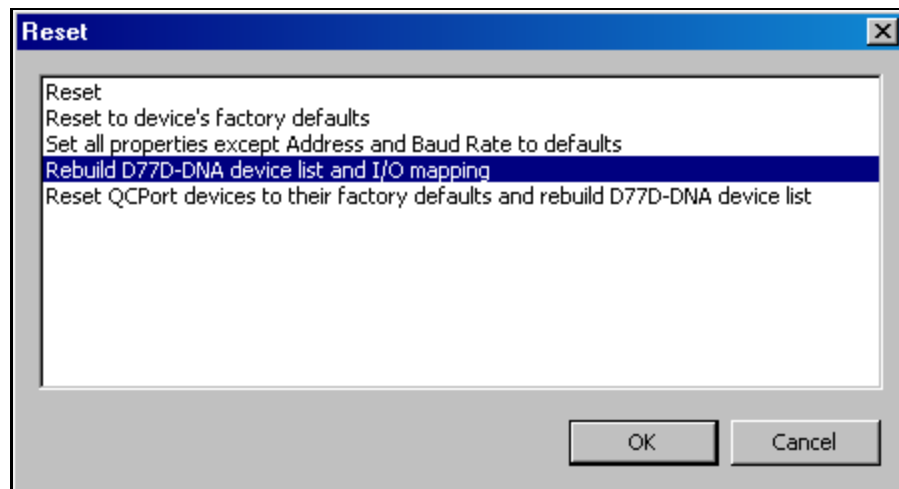


Figure 9: Reset Window

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Start Synchronization

The last step is to synchronize the offline project to the online system. It is important to verify that the addresses for both the D77B-QSNAP units and the D77D-DNA for the offline project match the online system. If they do not match, change one or the other until they do. The synchronize function works on an entire QCPort subnet, a single DeviceNet node (D77D-DNA) or a single QCPort device (D77B-QSNAP). The method is the same for all and this example demonstrates how to synchronize a single D77D-DNA.

1. Start with the offline project and select the offline D77D-DNA that you need to synchronize to the online system.
2. Place the cursor on the D77D-DNA and click once to highlight it.
3. Right mouse click and choose Synchronize or choose Synchronize from the toolbar. The Device Synchronize window is displayed.

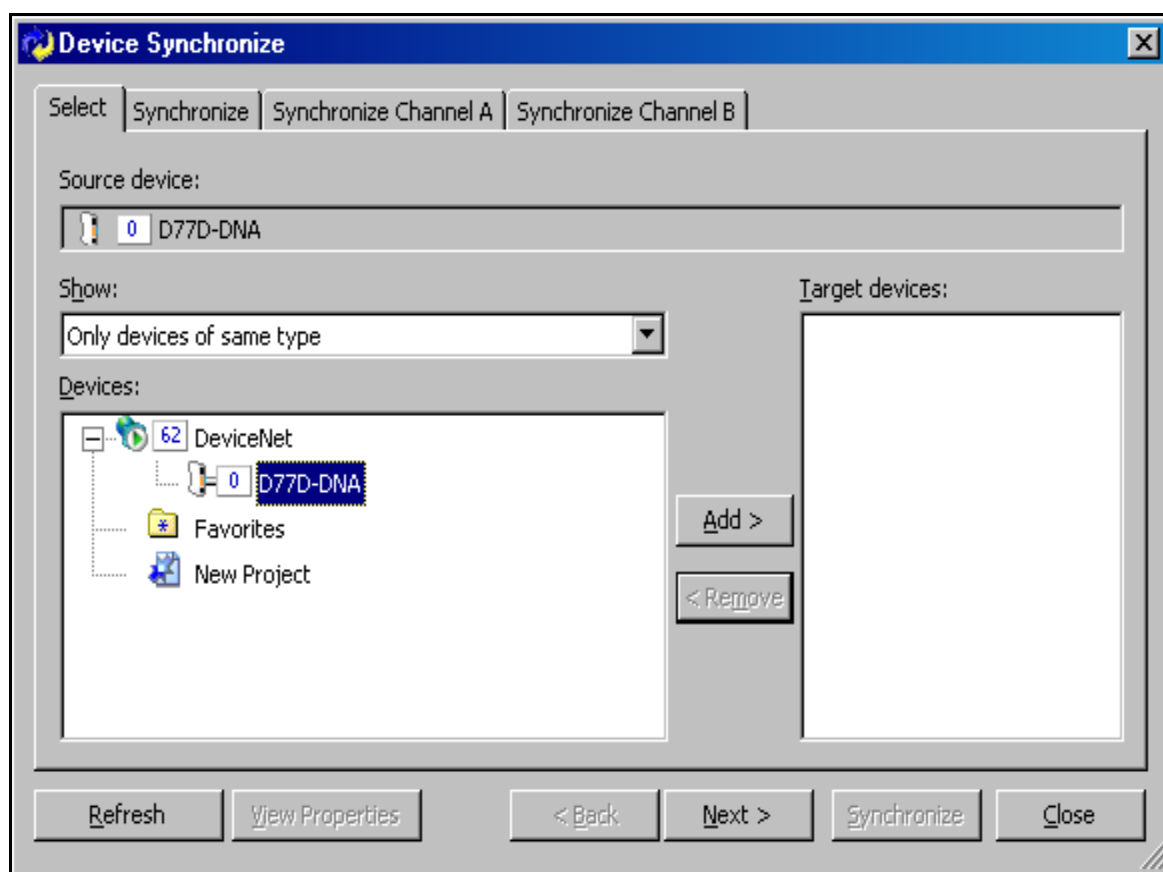


Figure 10: Synchronize Window

4. Select the target device and choose Add. This adds it to the Target devices section of the Device Synchronize window.

After that device is displayed in the Target Devices window, select the Synchronize Channel A tab. This tab displays all the devices from both the offline project and the online system (panel) and indicates if they need to be synchronized. If a device needs to be synchronized, a check mark is next to that device. If you only need to synchronize some of the parameters within a device, go to the *View Properties for Device Synchronization* section. If no other changes are required, press the Synchronize button to synchronize the offline system to the online system.

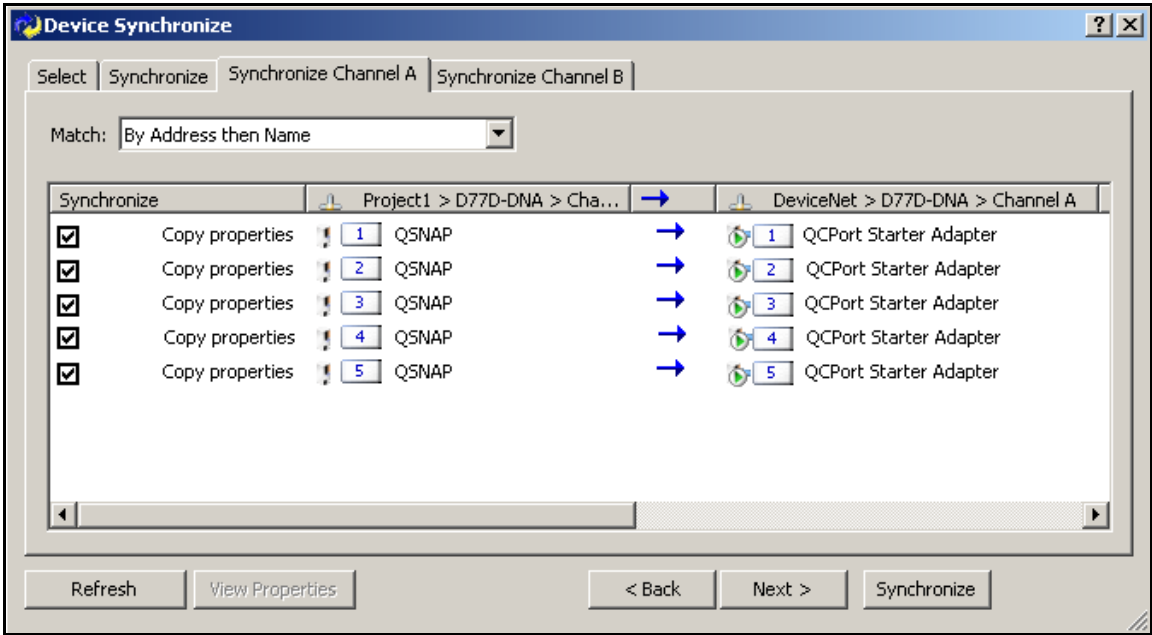


Figure 11: Synchronize Channel A Tab

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View Properties for Device Synchronization

If you want to view the properties of the devices prior to synchronization, select the device and press the View Properties button. This displays the offline project device next to the online device. The items with a checked box indicate a parameter that will be synchronized.

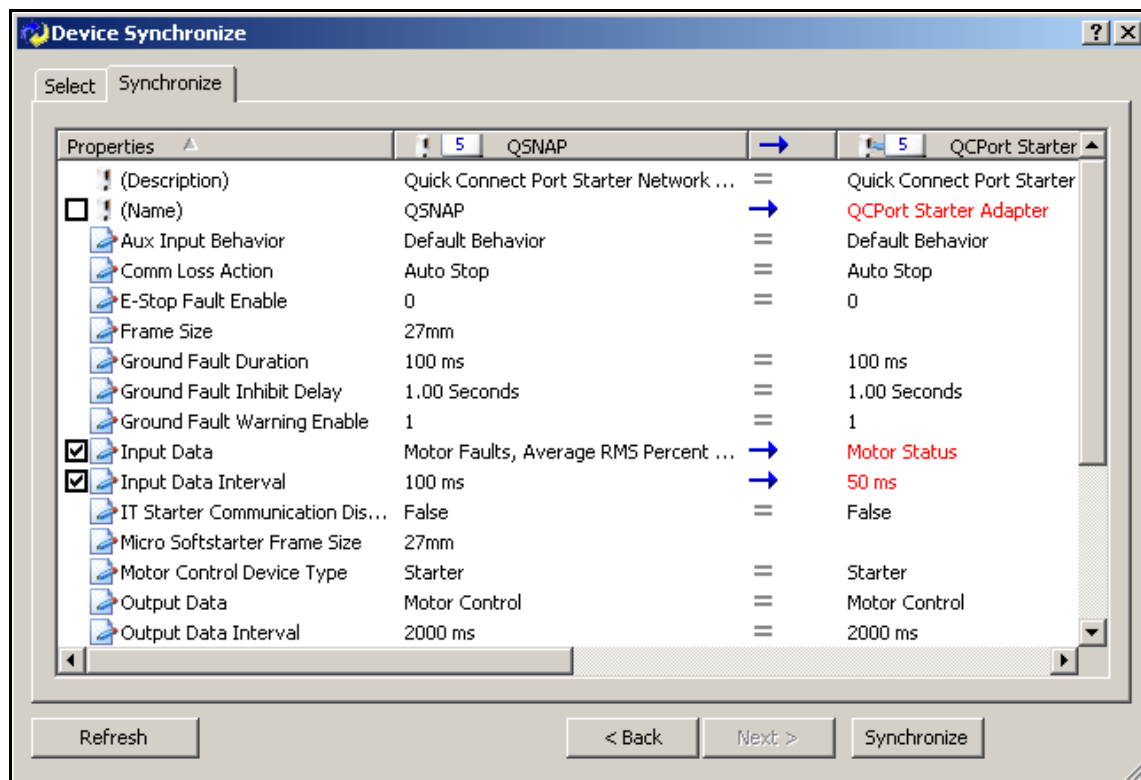


Figure 12: Property Synchronize Tab

The only configuration you need for normal operation of the D77B-QSNAP is to set the QCPort address, as described in the *Installation Section*, Page 11. However, the D77B-QSNAP offers a variety of enhanced features. When these features are required, use the CH Studio software suite to perform the configuration.

This section includes the following configuration procedures, and related instructions and information:

- Using CH Studio
 - View D77B-QSNAP General Properties
 - Configure Enhanced Features
 - Monitor the D77B-QSNAP Status
 - Change the I/O Assemblies

Using CH Studio Component Manager

The CH Studio software application is designed to program and configure industrial automation systems. The application simplifies the monitoring and configuration of entire networks, as well as the enhanced features of individual *IT.* communicating devices within those networks. Refer to **Page 8** for an example.

CH Studio takes advantage of the Windows graphical interface to present a suite of tools that is easy to learn and efficient to use, while meeting the requirements for developing complex network configurations. CH Studio performs the following configuration functions for QCPort networks:

- Discover network devices
- Display device properties
- Monitor and configure network devices
- Save existing network configurations
- Configure networks off-line
- Configure devices off-line

General Properties

The general properties of the D77B-QSNAP are located in the General Tab of the Property Pages for the device. The general properties include the firmware version, serial number, status and much more.

Configuring Enhanced Features

The enhanced features of the D77B-QSNAP are configured using the Property Window and the Property Pages. A complete list of all the features and settable attributes are available in the Properties Window.

Monitor the D77B-QSNAP

You can monitor the running values of the D77B-QSNAP (current, thermal capacity and 24V DC control voltage) from the Monitor Tab of the Property Pages. Switch to the Status Tab, to monitor all operational statuses.

Change the I/O Assemblies of the D77B-QSNAP

You can view and set all of the I/O assemblies from the I/O Info Tab of the Property Pages. To change the assembly, select the new assembly and press Apply in the lower right of the page. After choosing the new assembly, a representation of the data format and structure for the new I/O assembly is created.

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Auto Configuring the D77B-QSNAP for the Starter

1. Verify the D77B-RJJ1 is installed between J1 on the D77B-QSNAP and J1 on the Starter Terminal Adapter.
2. Connect the “out-of-box” D77B-QSNAP to a powered QCPort network.
3. Apply power to the starter terminal adapter; the ST LED should change from blinking red to blinking green.
4. Use CH Studio to verify that the starter was configured to the D77B-QSNAP, if possible.

Notice

The auto configuration can take as long as 15 seconds to complete on an S75x and 7 seconds for an **IT.** Starter.

The autoconfiguration is a semi-one-time event. If the D77B-QSNAP is moved to another starter of a different OL size, you are required to send a reset (blue button on the **IT.** Starter, remote reset from the HOA, or a reset over the network) for the D77B-QSNAP to accept the new starter.

Installation

Mount the D77B-QSNAP to the Starter

The *IT.* D77B-QSNAP is designed to be installed in the auxiliary contact locations of the *IT.* family of starters. On all starters, you can use one or more auxiliaries with the D77BQSNAP. The following table lists starters and indicates the number of available auxiliary locations for each.

Table 7: Starter Size/Available Auxiliary Locations on Mounted D77B-QSNAP

Starter Frame Size (mm)	Number of Available Auxiliary Locations with Center Mounted D77B-QSNAP
45	1 single Auxiliary
54	1 single or 1 dual Auxiliary
76	2 single or 2 dual Auxiliary
105	2 single or 2 dual Auxiliary
140	2 single or 2 dual Auxiliary

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Use the following steps and illustration in **Figure 13** to mount the D77B-QSNAP:

1. Align and insert both D77B-QSNAP feet into the auxiliary starter contact mounting slots, as illustrated in **Figure 13**.

Recommendation: Use the middle auxiliary contact mounting slot on the starter contact block when mounting the D77B-QSNAP.

2. Slide the D77B-QSNAP down until you hear a “click.” This ensures that the D77B-QSNAP is mounted securely to the starter.

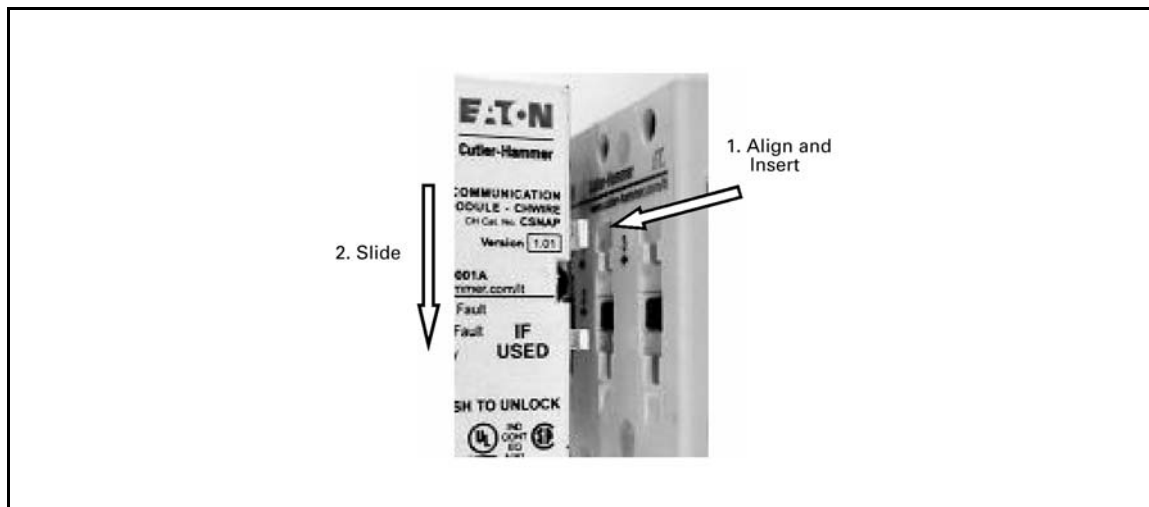


Figure 13: D77B-QSNAP Alignment and Mounting

Use the following steps and illustration in **Figure 14** to remove the D77B-QSNAP:

1. Press the **PUSH** tab protruding from the D77B-QSNAP front.
2. Slide the D77B-QSNAP up.
3. Pull the D77B-QSNAP away from the starter contact block.

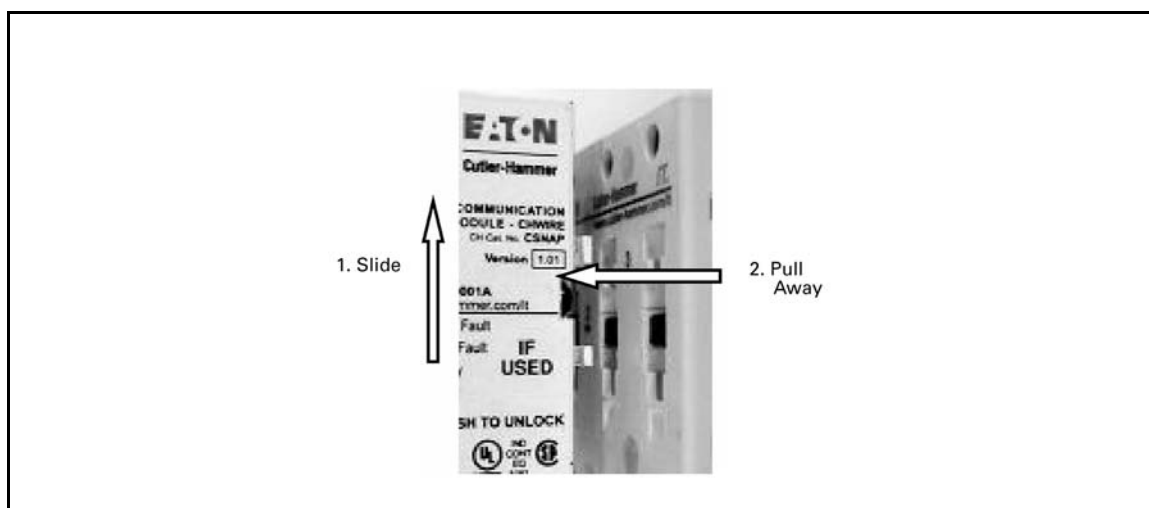


Figure 14: D77B-QSNAP Removal

Connect the Starter Terminal Adapter to the Starter

1. Loosen the screws on the removable terminal block of the starter.
2. Insert the Starter Terminal Adapter into the removable terminal block.
3. Tighten the screws on the terminal block (4.5 in-lb or 0.5 Nm), securing the Starter Terminal Adapter into the removable terminal block.
4. Install the removable terminal block into the starter.

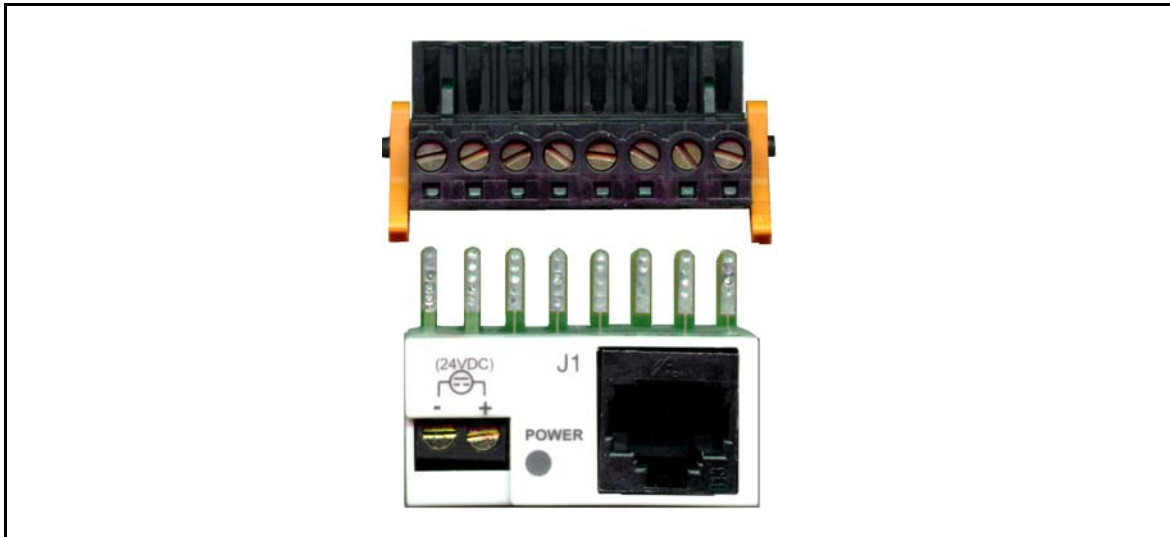


Figure 15: Connecting Starter Terminal Adapter

5. Insert one end of the Starter Adapter Jumper into J1 on the Starter Terminal Adapter and the other end into J1 on the D77B-QSNAP.

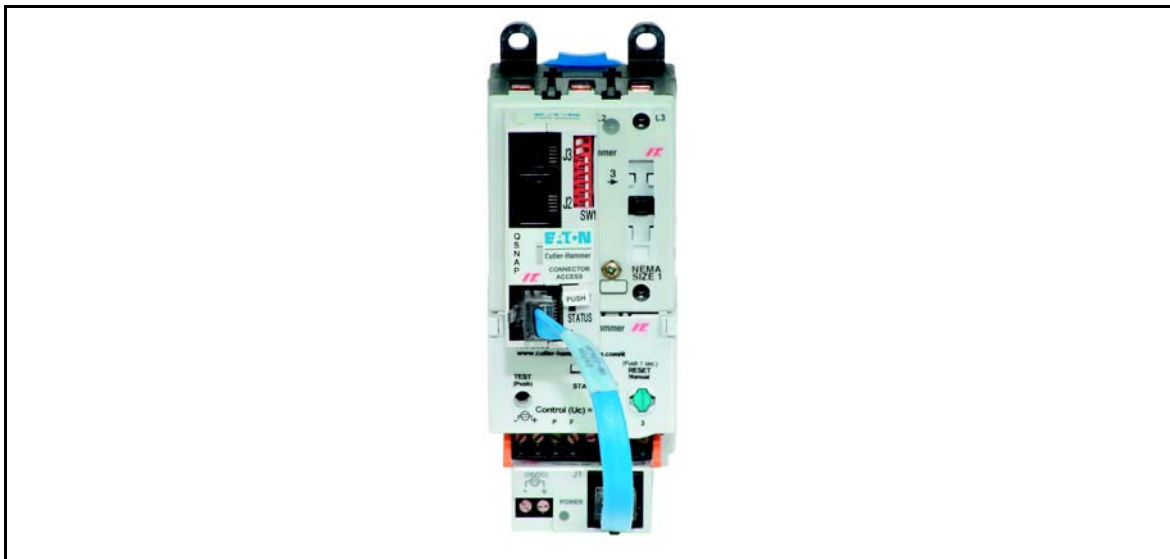


Figure 16: Jumper Installation

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Connect the D77B-QSNAP to QCPort

Using the D77E-QPIP interconnect cables, daisy chain the D77B-QSNAP together with the network adapter. The D77E-QPIP interconnect cables are specially designed for power and communications within in one cable.

Set the QCPort Address

You can set the QCPort address using the DIP switches on the front of the D77B-QSNAP or by using a software tool such as CH Studio.

- Refer to the following instructions, figure and table when setting the address. Moving a DIP switch to the right is ON, and moving the switch to the left is OFF. The address is in binary, with the major units numbered to the right of the switch on the side label. Adding up the major units set to ON determines the address of the D77B-QSNAP.

Example: To set the address to 25, start from the 32 switch and set the switches to OFF, ON, ON, OFF, OFF, ON (16+8+1=25).

The most significant bit is at the top or left end of the switch block.

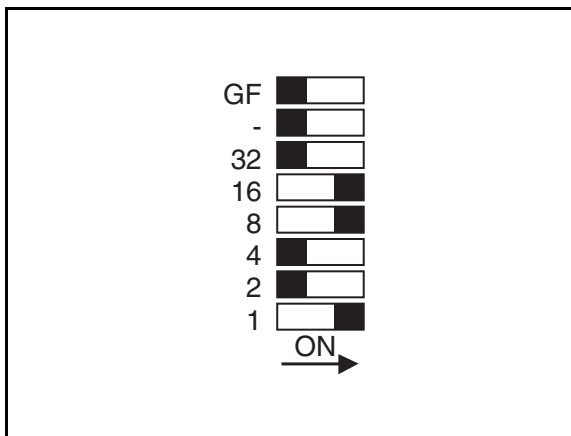


Figure 17: DIP Switch Setting Example

Input Output Data

The produced (input) and consumed (output) data for the QSNAP are identical, regardless if the QSNAP is connected to an IT non-reversing, reversing or S75x soft start. The default data is the data present when you perform an out-of-box reset, or when you receive it from the factory as factory default. You can individually add or remove each data item from the I/O message using CH Studio, allowing for custom I/O mapping configurations.

Default I/O Data

Table 8: Default Input Data

Byte	Data
0	Motor Control Faults (low byte)
1	Motor Control Faults (high byte)
2	% of FLA - running current/FLA setting on overload (low byte)
3	% of FLA - running current/FLA setting on overload (high byte)
4	Motor Control Status (byte)
5	Thermal Memory (byte)

Table 9: Motor Control Faults

Bit	Description
0	Phase Loss (Loss of one or more of the line phases or a Circuit Breaker Trip)
1	Phase Imbalance (current imbalance of greater than 50%)
2	Thermal Overload (starter trip due to thermal overload)
3	Reserved
4	Reserved
5	Ground Fault (trip due to a ground fault, separate ground fault sensor required)
6	Reserved
7	Reserved
8	Device Over Temperature (Device temperature limit exceeded, S75x only)
9	Reserved
10	Reserved
11	Motor Control E-Stop (Device is in the state of an Emergency Stop)
12	Reserved
13	Reserved
14	Reserved
15	Other, refer to Application Status (0x0004) and Fault Queue (0X001a)

Default I/O Data Descriptions

% FLA Word

The % FLA word is an integer from 0 to 65535 that indicates the % of FLA that the motor is running at. The % FLA is the running current divided by the FLA setting on the overload. For example, % FLA of 100 equals the RMS average current equal to the FLA setting on the overload.

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% Thermal Memory

The % thermal memory is a byte that models the temperature of the motor. When the % thermal memory reaches 100%, the overload will trip on thermal overload.

Table 10: Motor Control Status

Bit	Description
0	Running 1 (starter is commanded to run forward/fast)
1	Running 2 (starter is commanded to run reverse/slow)
2	Permissive
3	Reserved
4	Local Control
5	Faulted
6	Warning
7	At Reference

Running 1

If this bit is set, the QSNAP is commanding the starter to run (fwd) and has applied 24V to both the permissive and the run1 (FWD) terminals of the starter. It does not indicate the unit has energized, only that it was commanded to.

Running 2

If this bit is set, the QSNAP is commanding the starter to run (rev) and has applied 24V to both the permissive and the run2 (REV) terminals of the device. It does not indicate that the unit has energized, only that it was commanded to.

Permissive

If this bit is set, the Motor Control permissive is set.

Local Control

If this bit is set, the motor controller is controlled by the field wiring. When this bit is not set, the QSNAP is controlled by QCPort from the industrial fieldbus. The Auto/Hand terminal sets this bit on the HOA when used.

Warning

This bit is set when the D77B-QSNAP is in a warning state.

**CAUTION**

This bit is set when a warning is present. This can be any of the warnings listed on **Page 42**. It is not latched and automatically clears when the warning clears. A reset has no affect on a warning.

Fault

This bit is set when a fault occurs. This can be any of the faults listed. It is latched and requires a reset to clear the bit.

At reference

This bit indicates the state of the auxiliary cross bar sensors located on the motor controller. When the contactor is pulled in, this bit is true; when the contactor has dropped out, this bit is false. For example, a contactor that failed to open shows up as the At Reference bit being true, the Run1 (or Run2) being false, and a warning bit that is true. The warning is a failed to open warning. For a S75x soft start, this bit represents when the S75x is in bypass.

Extended Input Data

Table 11: Application Status

Byte	Data
0	Most Recent Fault/Warning Low Byte
1	Most Recent Fault/Warning High Byte

See **0x0004 (4) Application Status** on **Page 50** for more information.

Table 12: RMS AC Line Current (3 Φ average) (Amps)

Byte	Data
0	Low Byte
1	Middle Byte
2	Middle Byte
3	High Byte

See **0x0012 (18) RMS AC Line Current (3 Φ average) (Amps)** on **Page 52** for more information.

Table 13: DC Control Voltage

Byte	Data
0	Low Byte
1	High Byte

See **0x0016 (22) DC Control Voltage** on **Page 52** for more information.

Table 14: Fault Queue

Byte	Data
0	Most Recent Fault/Warning Low Byte
1	Most Recent Fault/Warning High Byte
2	Fault/Warning (second) Low Byte
3	Fault/Warning (second) High Byte
4	Fault/Warning (third) Low Byte
5	Fault/Warning (third) High Byte
6	Fault/Warning (fourth) Low Byte
7	Fault/Warning (fourth) High Byte
18	Fault/Warning (tenth) Low Byte
19	Fault/Warning (tenth) High Byte

See **0x001A (26) Fault Queue** on **Page 53** for more information.

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Table 15: Ave Pole Temperature

Byte	Data
0	Low Byte
1	High Byte

See **0x0029 (41) Ave Power Pole Temperature** on **Page 53** for more information.

Table 16: Compressed Production Data

7	6	5	4	3	2	1	0	Byte
Aux 1 Input Status	Over Current Warning	No E-Stop	Ground Fault	Underload Warning	Thermal OL	Phase Imbalance	Phase Loss	0

See **0x0057 (87) Compressed Production Data** on **Page 54** for more information.

Phase Loss

Set to true when a phase loss is detected in the overload or when a circuit breaker trip is active.

Phase Imbalance

Set to true when a phase imbalance is detected in the overload.

Thermal Overload

Set to true when a thermal overload occurred in the overload.

Under Current Warning

Set to true when the running current is less than the low current warning level.

Ground Fault

Set to true when a ground fault is active (circuit is open); ground fault should be latching to maintain the ground fault.

No E-Stop

Set to false when there is an E-Stop.

Over Current Warning

Set to true when the running current is more than the high current warning level.

Aux 1 Input Status

Set to true when contactor is closed.

Table 17: RMS Scaled Current

Byte	Data
0	Low Byte
1	High Byte

This two-byte value indicates the scaled RMS current.

See **0x0058 (88) RMS Average Scaled Current (milli Amp)** on **Page 54** for more information.

Parameter 88 is scaled to 0.001 amps (milli A), 65536 = 65.536 amps

Parameter 89 is scaled to 0.01 amps (centi A), 65536 = 655.36 amps

Parameter 90 is scaled to 0.1 amps (deci A), 65536 = 6553.6 amps

Parameter 90 is scaled to 1 amps (A), 65536 = 65536 amps

Table 18: Field Wiring Status

7	6	5	4	3	2	1	0	Byte
E-Stop	Contact Closed	Aux 2	Aux 1	HOA Hand - Auto	HOA Reset	HOA Run2	HOA Run1	0

See **0x005C (92) Field Wiring Status** on **Page 55** for more information

HOA Run1 — Run 1 command from HOA is true

HOA Run2 — Run 2 command from HOA is true

HOA Reset — Reset on HOA is true

HOA Hand/Auto — Hand is true, Auto is false

Aux 0 — Open is true

Aux 1 — Open is true

Contact Closed — Primary contactor is closed

No E-Stop — E-Stop, true when in E-Stop

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Table 19: 3-Wire Control Output Data (Default)

Byte	Data
0	Motor Control (byte)

Table 20: Motor Control

Bit	Description	State
0	Run 1 (command the primary contactor to energize)	Momentary
1	Run 2 (command the secondary contactor to energize)	Momentary
2	Permissive (permissive to energize the starter)	Maintained
3	Reset	Momentary
4	Reserved	NA
5	Reserved	NA
6	Reserved	NA
7	Reserved	NA

Run1

This bit and the permissive must be true for the motor controller to energize in the forward direction. Once the motor controller is running, this bit is not required to be true to continue running.

Run2

This bit and the permissive must be true for the motor controller to energize in the reverse direction. Once the motor controller is running, this bit is not required to be true to continue running.

Permissive

You must set this bit any time the motor controller is expected to be running. If the permissive is not set, the motor controller can not run.

The internal logic is a 3-wire control circuit. The Permissive must be true and maintained to energize the starter (and keep it energized). The Run 1 and Run 2 commands are momentary, though you can keep this maintained with the Permissive and drop both the bits (Run1 and Permissive, or Run2 and Permissive) when a stop is required.

3-Wire Logic

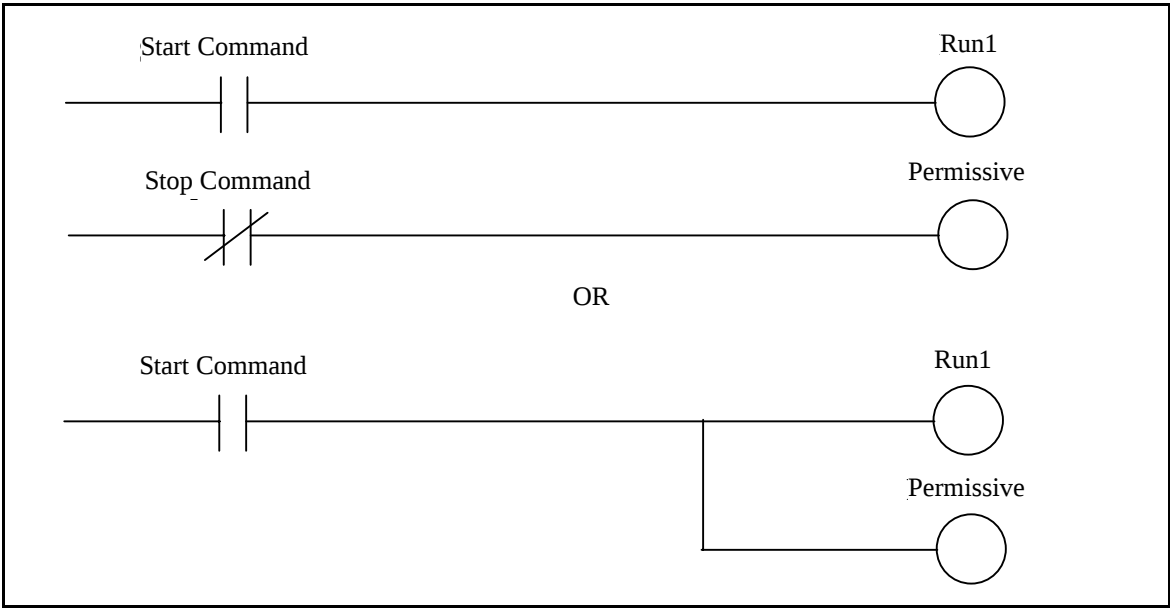


Figure 18: 3-Wire Logic

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2-Wire Control Output Data**Table 21: Motor Control Byte**

Byte	Data
0	Motor Control (byte)

Table 22: Motor Control

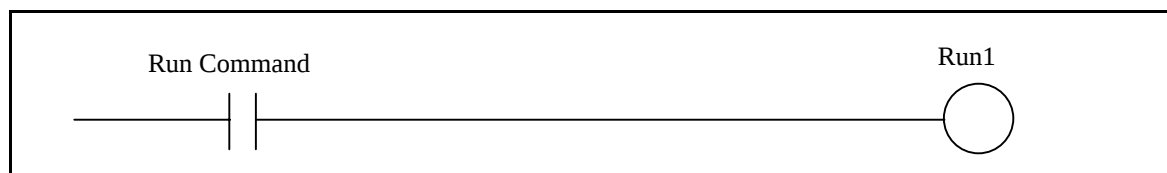
Bit	Description	State
0	Run 1 (command the primary contactor to energize)	Momentary
1	Run 2 (command the secondary contactor to energize)	Momentary
2	Reserved	NA
3	Reset	Momentary
4	Reserved	NA
5	Reserved	NA
6	Reserved	NA
7	Reserved	NA

Run1

This bit must be true for the motor controller to energize in the forward direction. When the bit is false, the motor controller de-energizes.

Run2

This bit must be true for the motor controller to energize in the reverse direction. When the bit is false, the motor controller de-energizes.

2-Wire Logic**Figure 19: 2-Wire Logic**

Auxiliary Inputs

Using the Auxiliary Inputs as Field Inputs

You can use the auxiliary inputs, Ground Fault input and Second Contactor Auxiliary input, as general purpose inputs for applications where those inputs are not being used. Since the inputs are not isolated, it is suggested that you use an interposing relay when connecting to field inputs. The interposing relay contacts must be rated for 24V DC.

Table 23: Auxiliary Input Specifications

Description	Rating
Rated Voltage	24V DC
ON-State Voltage	8V DC
ON-State Current	1 mA @ 24V DC

Table 24: Predefined Auxiliary Functions

Inputs	Functions
Aux 1	Second Auxiliary for Reversing Contactor
Aux 2	Ground Fault Relay

Connect the interposing relay as shown.

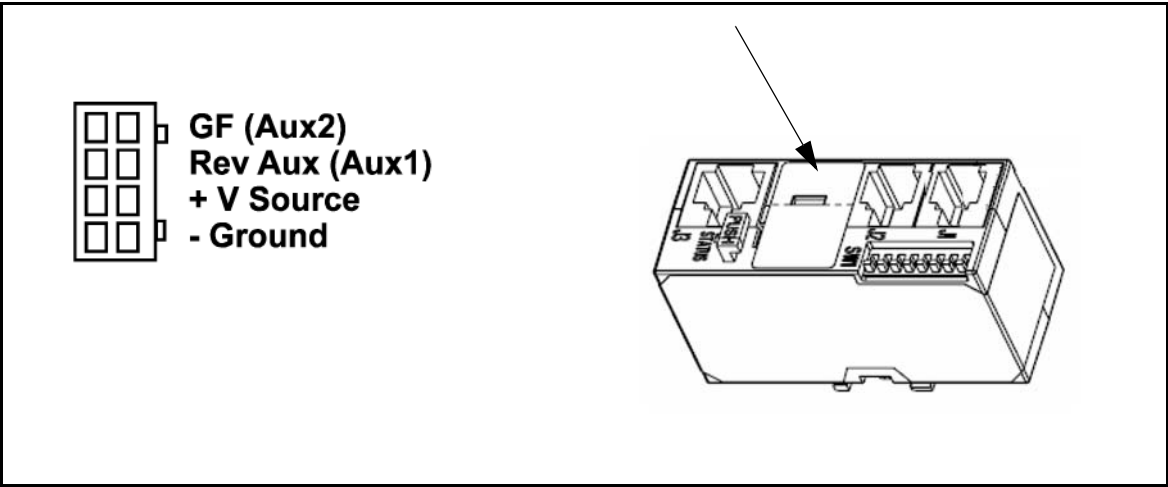


Figure 20: Auxiliary I/O for QSNAP

Notice

Wire leads from the auxiliary I/O connector to the interposing relays should be as short as possible and should not have any contact with AC wires or the motor leads.

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Notice

If the application requires ground fault, the ground fault relay is connected to Aux 2, and only Aux 1 is available for the field input. If the application requires a Full Voltage Reversing (FVR) starter, the second contact is connected to Aux 1, and only Aux 2 is available for the field input. If the application requires both a ground fault relay and Full Voltage Reversing (FVR) starter, then no field inputs are available.

**CAUTION**

Unplug the D77B-QSNAP from the QCPort prior to mounting it to another *IT.* Starter. The +V Source pin is a positive 24V DC source that is only rated for the load of Aux 1 and Aux 2. Damage of the D77B-QSNAP occurs if that source voltage is used for powering secondary devices.

Operation

This section provides details about the following features and functions of D77B-QSNAP operation:

- “Out-of-Box” operation
- Quick Start
- Typical application
- Enhanced features
- QCPort input/output assemblies
- QCPort Status LED
- Functional Description

“Out-of-Box” Operation

Notice

Before applying power to the D77B-QSNAP for the first time, make sure it is properly mounted on the starter and that all connections are made (QCPort, terminal adapter and auxiliary connector).

When the D77B-QSNAP is properly installed on an **IT.** Starter, and has a properly set node address, per the **Power Source** section on **Page 7**, the following tables in the **Quick Start** section indicate the information to expect for I/O assemblies on QCPort.

To reset the D77B-QSNAP to the “**Out-of-Box**” **Operation** once it has been associated to a starter, follow the instructions in **Appendix A: Supported QCPort Object** on **Page 50**.

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Quick Start

This part of the section provides the information necessary to install and operate the D77B-QSNAP on a Full Voltage Non-reversing (FVNR) *IT.* Starter, Full Voltage Reversing (FVR) *IT.* Starter, and an S75x Soft Start motor controller. Detailed information is available in **Appendix A: Supported QCPort Object** for setup of enhanced parameters and extended Input and Output data (assemblies).

FVNR Motor Controller

1. Follow the instructions to mount the D77B-QSNAP, outlined in **Mount the D77B-QSNAP to the Starter on Page 20.**
2. Follow the instruction to connect the Starter Terminal Adapter to the starter, outlined in **Connect the Starter Terminal Adapter to the Starter on Page 22.**

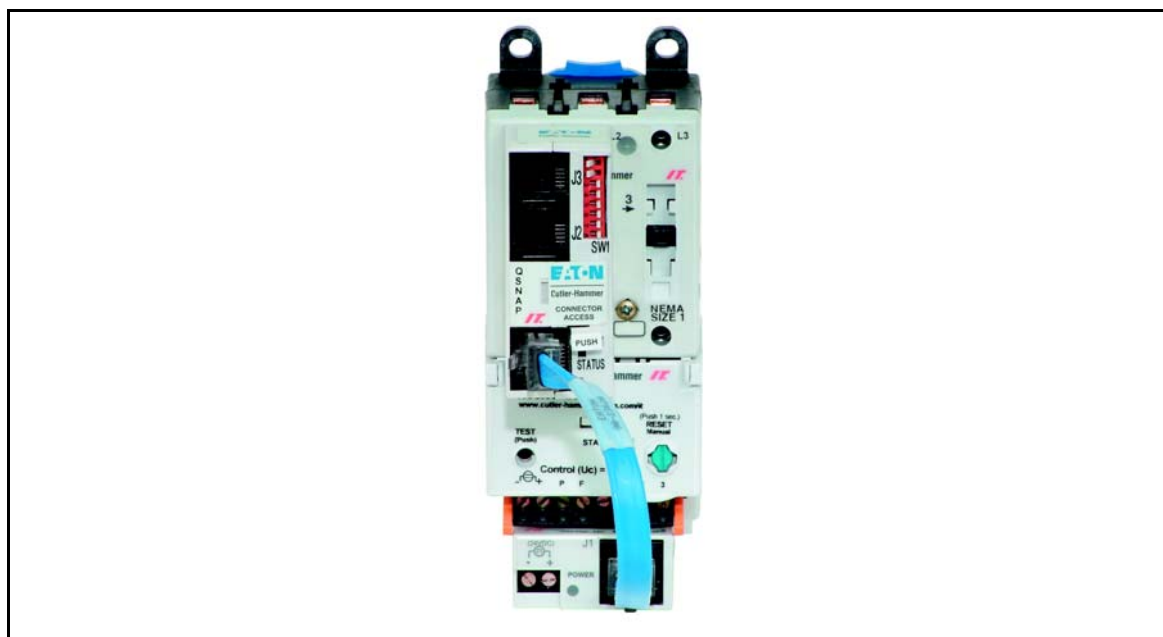


Figure 21: FVNR Motor Controller

3. Follow the instructions to set the address, outlined in **Set the QCPort Address on Page 23.**
4. Follow the instructions to connect the D77B-QSNAP to QCPort, outlined in **Connect the D77B-QSNAP to QCPort on Page 23.**

The D77B-QSNAP auto configures to the FVNR *IT.* Starter when the D77B-QSNAP and the *IT.* Starter are first powered (together). After the auto configuration is complete, the D77B-QSNAP is associated to that specific size, type and overload range of *IT.* Starter. Any attempt to install an already “associated” D77B-QSNAP onto another *IT.* Starter will require a reset to the D77B-QSNAP. A reset can be pressing the blue reset button on the IT Starter, performing a remote reset from the HOA or performing a reset from the industrial network.

The I/O data is the same regardless of the type of starter the D77B-QSNAP is connected to. Refer to **Table 8** on **Page 24** for an example of the input data. Refer to **Table 10** on **Page 25** for an example of the output data.

FVR Motor Controller

1. Follow the instructions to mount the D77B-QSNAP, outlined in **Mount the D77B-QSNAP to the Starter** on **Page 20**.

Notice

The 45 mm and 54 mm frame **IT.** Starters require you to depress the fanning strip cover locking tab while installing the D77B-QSNAP. Depress the tab while inserting the D77B-QSNAP feet into the slot on the **IT.** Starter to ease installation.

2. Follow the instructions to connect the Starter Terminal Adapter to the starter, outlined in **Connect the Starter Terminal Adapter to the Starter** on **Page 22**.

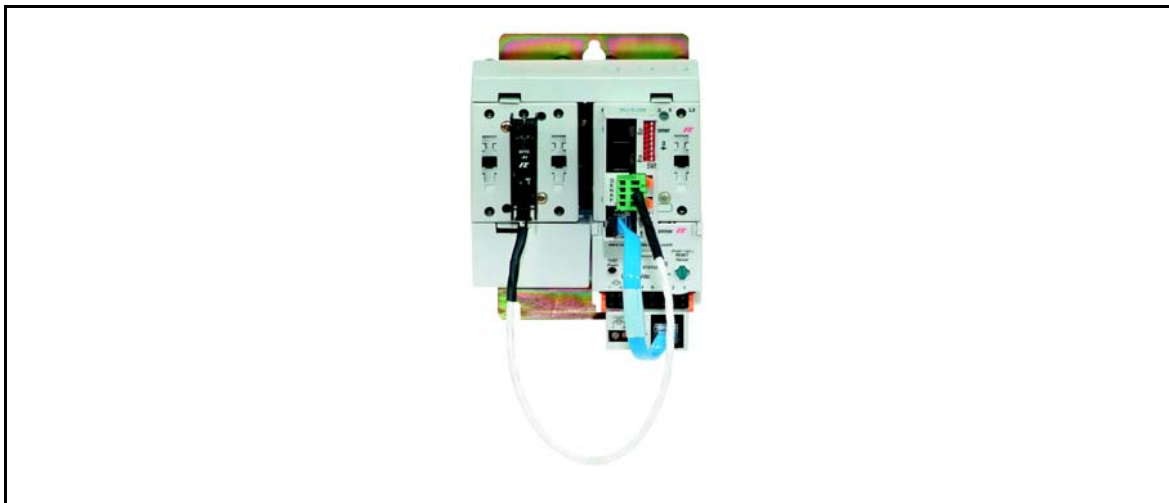


Figure 22: FVR Motor Controller

3. Install the secondary contactor sensor (D77C-A1) on the second contactor just as you would install an auxiliary (align the feet and slide towards the bottom).
 - a. Use a screwdriver to pry up the connector access breakout (**Figure 1** on **Page 6**) and remove the breakout.
4. Insert the green connector that is connected via a wire to the second contactor sensor into the breakout. Be sure to pay attention to the alignment tabs for proper orientation.
5. Follow the instructions to set the address, outlined in **Set the QCPort Address** on **Page 23**.
6. Follow the instructions to connect the D77B-QSNAP to QCPort, outlined in **Connect the D77B-QSNAP to QCPort** on **Page 23**.

The D77B-QSNAP auto configures to the FVR **IT.** Starter when the D77B-QSNAP and the **IT.** Starter are first powered (together). Make sure the second contactor sensor is installed (D77C-A1) and the green connector is installed into the breakout. If this is not performed, the auto configuration does not set the D77B-QSNAP for an FVNR **IT.** Starter. After the auto configuration is complete, the D77B-QSNAP is “associated” to that specific size, type and overload range of **IT.** Starter. Any attempt to install an already associated D77B-QSNAP requires a reset to the D77B-QSNAP. A reset can be pressing the blue reset button on the **IT.** Starter, performing a remote reset from the HOA, or performing a reset from the industrial network.

Refer to **Table 8** on **Page 24** for an example of the input data. Refer to **Table 10** on **Page 25** for an example of the output data.

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S75x Soft Starter

1. Follow the instructions to mount the D77B-QSNAP, outlined in **Mount the D77B-QSNAP to the Starter on Page 20** (mounts in the same position as an FVNR starter).
2. Follow the instructions to connect the Starter Terminal Adapter to the starter, outlined in **Connect the Starter Terminal Adapter to the Starter on Page 22**.
3. Follow the instructions to set the address, outlined in **Set the QCPort Address on Page 23**.
4. Follow the instructions to connect the D77B-QSNAP to QCPort, outlined in **Connect the D77B-QSNAP to QCPort on Page 23**.

The D77B-QSNAP auto configures to the S75x *IT.* Soft Starter when the D77B-QSNAP and the *IT.* Soft Starter are first powered (together). After the auto configuration is complete, the D77B-QSNAP is associated to that specific size, type and overload range of *IT.* Soft Starter. Any attempt to install an already associated D77B-QSNAP onto another *IT.* Starter requires a reset to the D77B-QSNAP. A reset can be pressing the blue reset button on the *IT.* Starter, performing a remote reset from the HOA, or performing a reset from the industrial network.

Refer to **Table 8 on Page 24** for an example of the input data. Refer to **Table 10 on Page 25** for an example of the output data.

HOA Terminal Adapter Option

The HOA option allows you to connect hard wire controls to the D77B-QSNAP for a true HAND/OFF/AUTO operation. This option also provides for an alarm output to provide status of a starter trip.

1. Follow the instructions to mount the D77B-QSNAP, outlined in **Mount the D77B-QSNAP to the Starter** on **Page 20**.
2. Connect the D77B-HOA8 HOA Terminal Adapter to the starter, outlined in **Connect the Starter Terminal Adapter to the Starter** on **Page 22**.

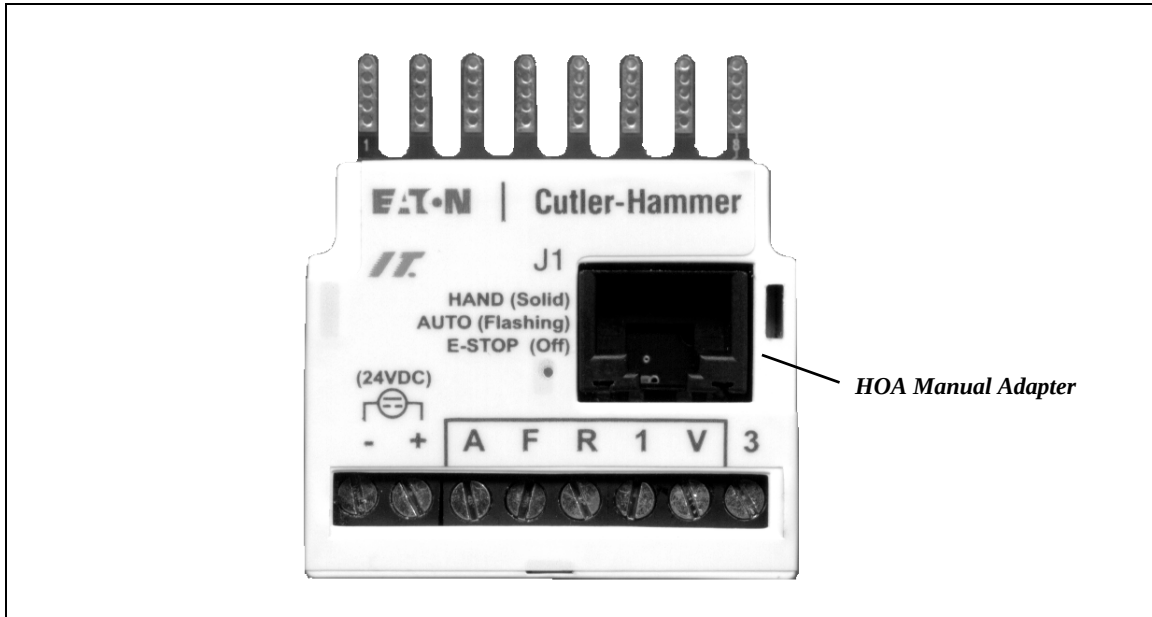


Figure 23: HOA Starter Terminal Adapter

3. Follow the instructions to set the address, outlined in **Set the QCPort Address** on **Page 23**.
4. Follow the instructions to connect the D77B-QSNAP to QCPort as outlined in **Connect the D77B-QSNAP to QCPort** on **Page 23**.

The D77B-QSNAP auto configures to the **IT.** Starter when the D77B-QSNAP and the **IT.** Starter are first powered (together). After the auto configuration is complete, the D77B-QSNAP is “associated” to that specific size, type and overload range of **IT.** Starter. Any attempt to install an already “associated” D77B-QSNAP onto another **IT.** Starter requires a reset to the D77B-QSNAP. A reset can be pressing the blue reset button on the **IT.** Starter, performing a remote reset from the HOA, or performing a reset from the industrial network

5. Follow the wiring directions below to properly wire the D77B-HOA8 for HAND/OFF/AUTO (HOA) control. The HOA connects to FVNR, FVR and S75x Soft Starter **IT.** Starters.

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Wiring the D77B-HOA8

There are eight terminals on the front of the D77B-HOA8. They are:

1. Power Negative (-)
2. Power Positive (+) 24V DC
3. Auto (A) — Auto = 1/Hand = 0
4. Forward (F) — When in Hand, F = Forward/Run
5. Reverse (R) — When in Hand, R = Reverse
6. Remote Reset (1) — Remote reset always active
7. Source (V) — Source power for A, F, R and 1
8. Alarm Out (3) — Indication of starter trip (OL, Phase Loss, Phase Imbalance)

Connect the **IT.** Starter/Soft Starter power supply to terminals (-) and (+); the wiring for the HOA will connect to A, F, R, 1, and V. When using HOA, wire an E-Stop circuit through the (+) terminal. Refer to **Figure 2** for details on wiring the E-Stop.

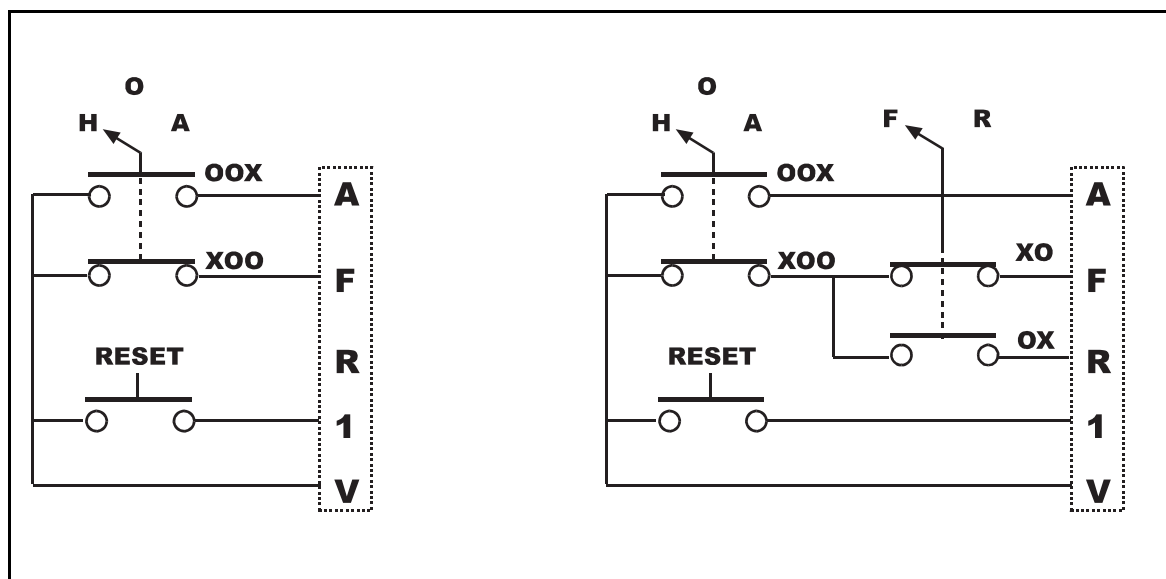


Figure 24: Full Voltage Non-reversing and Full Voltage Reversing 2-Wire Control

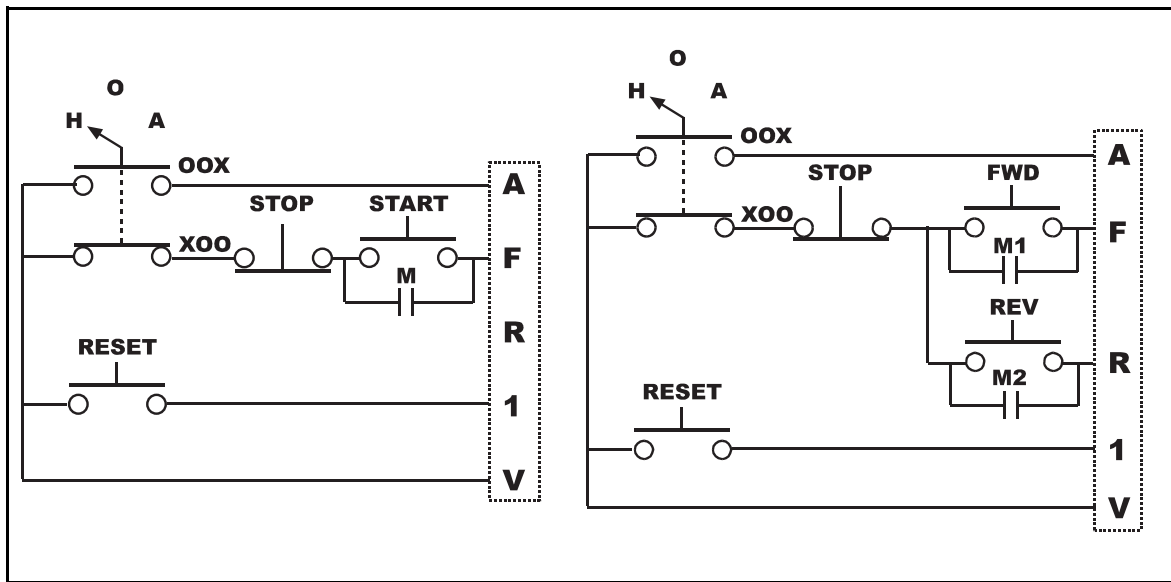


Figure 25: Full Voltage Non-reversing and Full Voltage Reversing 3-Wire Control

There are many ways to wire the HOA; in all cases the control is a two-wire mode. You can use PLC outputs (solid-state or relay), switches or push-button to activate the input devices. For your convenience, non-isolated source power is provided at the V terminal for all the inputs. The total power available is less than 50 mA and is not intended to power external pilots or actuators. **Damage to the device can occur if you do not adhere to the preceding wiring guidelines.**

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D77B-HOA8 LED Indication

There is an LED on the D77B-HOA8; this LED is a multifunction to alert you to the mode of operation.

LED = Solid ON = HAND Mode

LED = Mostly ON (Blinking) = AUTO Mode

LED = Rapid Flash (Fast Blink) = HOA8 Communication Error

LED = OFF = E-Stop/No Power

D77B-HOA8 Alarm Output

The D77B-HOA8 has a single alarm output to indicate starter trip, including thermal overload, phase imbalance, phase loss and test trip. The output is current sourcing; you must wire any annunciating device between the 3 terminal and the (-) terminal. The intention is for this output to connect to a pilot device or PLC input. Inductive loads are not recommended with this output. **The output is rated at 250 mA and is not current limited.**

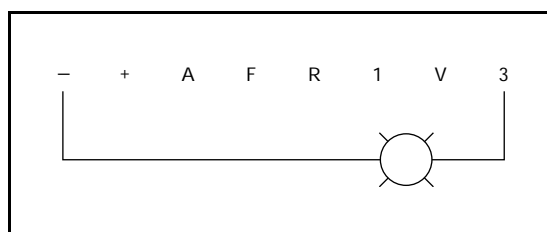


Figure 26: Alarm Output Wiring

Operation of the D77B-HOA8

When the D77B-HOA8 is operating in AUTO, the starter operates via Network control sent to the D77B-QSNAP. The F and R terminals are inactive when in AUTO. When the D77B-HOA8 is in Hand, the D77B-HOA8 terminals control the starter. In HAND, the F and R terminals command the starter to operate in Run/Forward or Reverse. The D77B-QSNAP still monitors the starter's status (including current and fault codes) and relays to the QCPort when the D77B-HOA8 is in HAND mode. At all times the Remote Reset (1) terminal is active. **The D77B-QSNAP does not need to be powered or present for the D77B-HOA8 to operate the starter in HAND mode.**

Adding the D77B-HOA8 does not affect the default I/O assemblies for the D77B-QSNAP. Refer to the proper Quick Start example for the default I/O assembly on **Page 35**.

Fault and Warning Codes

When bit 15 is set in the fault or warning code, it signifies that the fault or warning is extended. The codes for the extended faults and warnings are listed below.

Table 25: Fault Codes

Fault Code	Hex Code	Dec
No Fault	0x00	0
Application Communication Failure	0x03	3
Control Device High Temperature (S75x only)	0x05	5
Phase Loss	0x06	6
Phase Imbalance	0x07	7
Ground Fault	0x08	8
Bypass Failure	0x0D	13
Thermal Overload Fault	0x0E	14
Test Fault	0x0F	15
Invalid Device Connected to Cover Control (S751 Rev A is connected)	0x11	17
Motor Control Communication Loss All Stop Fault	0x24	36
E-Stop Fault (Register 19=1)	0x36	54
Hand Motor Control Command Missing	0x37	54

Table 26: Warning Codes

Warning Code	Hex Code	Dec
Over Current Warning	0x9C40	40000
Under Load Warning	0x9C41	40001
Motor Phase Loss Warning (S75X only)	0x9C44	40004
Impending Trip	0x9C46	40006
Ground Fault Warning	0x9C47	40007
Device Configuration is Invalid	0x9C48	40008
Run1 Bypass Failure to Close	0x9C49	40009
Run1 Bypass Failure to Open	0x9C4A	40010
Run2 Bypass Failure to Close	0x9C4B	40011
Run2 Bypass Failure to Open	0x9C4C	40012
Emergency Stop Warning	0x9C4D	40013
Motor Direction Command Conflict	0x9C4E	40014

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Communication Loss Behavior

If for any time there is a loss of communications between the network adapter and the D77B-QSNAP, the D77B-QSNAP enters the communication loss behavior. This behavior is set using CH Studio and has the following choices:

- Stop
- Hold last state
- Run1
- Run2
- All stop

The behaviors are described in parameter 0x804E in **Appendix A: Supported QCPort Object**.

⚠ **WARNING**

If the communication loss behavior is set to Run1 or Run2, **any time** the D77B-QSNAP is powered **and is not being scanned on QCPort**, the motor controller is commanded to the communication loss behavior. This does not include when first powering up the D77B-QSNAP.

Typical Application

A typical application of a D77B-QSNAP includes other DeviceNet devices and the D77B-QSNAP. A panel can contain discrete I/O, analog I/O, and starters and soft starters connected to D77B-QSNAP products. All of the DeviceNet devices are then connected to a network adapter for control and monitoring the DeviceNet.

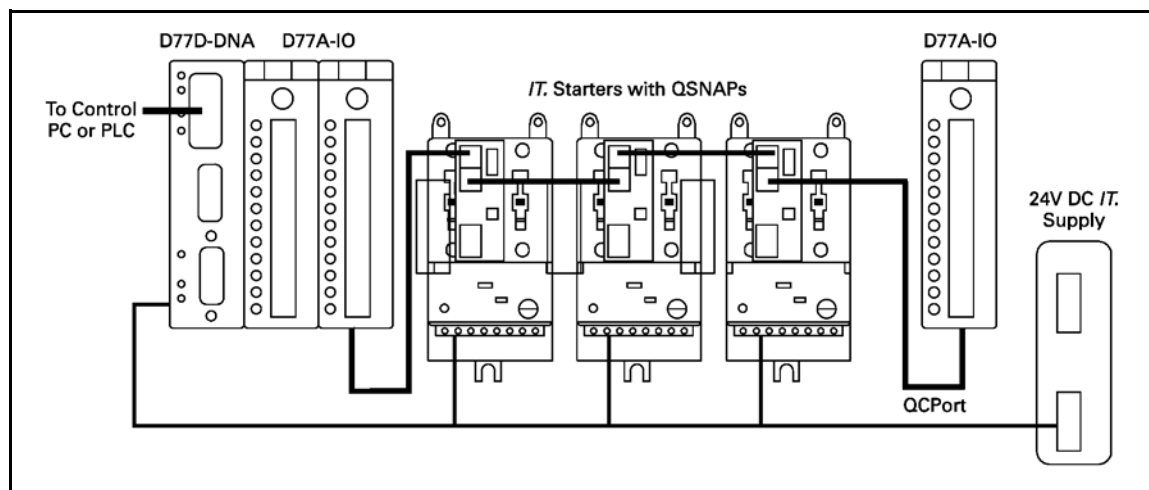


Figure 27: Typical D77B-QSNAP Application

Features

Table 27: Standard Protective Features

Trip	Definition
Phase Current Unbalance/Phase Loss	A phase current unbalance trip occurs if one or two of the line currents are 40 - 60% or less of the remaining line(s) for longer than 10 seconds. A phase loss trip occurs with a load current of at least 75% of the minimum FLA, if one of the two input line voltages is lost, with the line current going to zero for longer than 10 seconds.
Thermal Overload	While the motor is running and depending on the FLA and trip class settings, when the FLA is exceeded for a period of time (depending on the trip class setting), a thermal overload trip occurs. For more information on this feature, see the <i>Contactors and Starter User Manual</i> (Publication No. 49400).

Notice

The threshold values for Thermal Overload and Phase Current Unbalance cannot be modified.

Table 28: Enhanced Features

Fault	Definition
Ground Fault	With the addition of a Ground Fault module, the D77B-QSNAP trips when the module detects a ground fault. The level of the trip is adjusted on the Ground Fault Module. The Ground Fault Module is connected to the D77B-QSNAP through the Auxiliary opening on the front of the D77B-QSNAP.
Low Current Warning	While the motor is running, a warning is activated when the current falls below a user-settable % of overload's FLA pot setting.
High Current Warning	While the motor is running, a warning is activated when the current rises above a user-settable % of overload's FLA pot setting.
SCR Over Temperature	To protect the SCRs from premature damage, a temperature sensor monitors the SCR temperature. If the monitored temperature is too high, the S75x trips the SCR overtemperature on.
Contactors Dropout	The contactor dropped out when it was commanded to energize.

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Functional Description

Table 29: Truth Table

Old State	Fieldbus Inputs			Event	New State	Action
	Run 1	Run 2	Reset			
FAULTED	—	—	—	RESET	OFF	FAULT = 0
OFF	0	0	—	NONE	OFF	NONE
OFF	1	0	—	RUN 1	RUNNING 1	RUNNING 1 = 1
OFF	0	1	—	RUN 2	RUNNING 2	RUNNING 2 = 1
OFF	1	1	—	RUN 1/RUN 2	OFF	NONE
RUNNING 1	1	1	—	RUN 2	RUNNING 1	NONE
RUNNING 2	1	1	—	RUN 1	RUNNING 2	NONE
RUNNING 1	1	0	—	FAULT	FAULTED	RUNNING 1 = 0 FAULT = 1
RUNNING 2	0	1	—	FAULT	FAULTED	RUNNING 2 = 0 FAULT = 1
RUNNING 1	1	0	—	WARNING	RUNNING 1	WARNING = 1
RUNNING 2	0	1	—	WARNING	RUNNING 2	WARNING = 1

— = state not important
 1 = state true (energized)
 0 = state false (de-energized)
 WARNING = any warning in Table 45

RUNNING 1 = Run/FWD/SLOW
 RUNNING 2 = REV/FAST
 FAULT = any fault in Table 44

Troubleshooting and Maintenance

Renewal Parts

The following table lists the renewal parts for the **IT.** D77B-QSNAP.

Table 30: D77B-QSNAP Renewal Parts

Description	Catalog Number
D77B-QSNAP Assembly of terminal adapter, jumper and D77B-QSNAP for FVNR applications	D77B-QSNAP-X1
D77B-QSNAP Assembly of terminal adapter, jumper, D77B-QSNAP and second contactor sensor for FVR applications	D77B-QSNAP-X2
D77B-QSNAP Assembly of HOA adapter, jumper and D77B-QSNAP for FVNR applications	D77B-QSNAP-X3
D77B-QSNAP Assembly of HOA adapter, jumper, D77B-QSNAP and second contactor sensor for FVR applications	D77B-QSNAP-X4
Required QSNAP Adapter Kit for the 140 mm (Size 5 and F) Starter	D77B-140A
Input auxiliary for D77B-QSNAP	D77B-AC1
Hands Off Auto Adapter for SNAP family	D77B-HOA8

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Troubleshooting

General Troubleshooting Hints

If the listed solutions do not solve the problem, consult the factory or technical support.

Table 31: Troubleshooting

Problem	Solution
The starter periodically drops out while running.	Check the length and routing of the E-Stop wiring. It is possible that the length of the E-Stop circuit is too long. To test this, place a jumper from the power supply to the power terminals on the SNAP terminal adapter and see if the problem goes away. If it does, you may need to install an interposing relay between the E-Stop circuit and the SNAP terminal adapter. Verify that the control program is not dropping the starter out inadvertently. Check the system controller to verify that the scan bit is for the network adapter (bit 0 of byte 0 for CH_A and bit 0 of byte 1 for CH_B). Verify the offsets within the memory map in the system controller for errors. Check the status LED for the selected devices. It should be a solid ON green, which means the SNAP is being scanned.
Has a constant "Fail to Open" or "Fail to Close" warning.	The internal plunger on the SNAP may be window locked or damaged. Remove the SNAP and verify movement of the plunger. If this warning is for the second contactor, the D77B-AC1 may not be installed correctly or the auxiliary may be damaged.
While On-line with CH Studio, the Network Adapter or the D77B-QSNAP disappears.	The controller may not be allowing enough time for the CH Studio messages. The connection between CH Studio and the Network Adapter is timing out. You may have to take the system controller off-line to continue.
While looking at the D77B-QSNAP, you notice that the status LED is solid on.	It is possible the D77B-QSNAP was placed into a firmware download mode. Cycle power to the D77B-QSNAP and see if the LED behaves properly.

Communication Troubleshooting Hints**Table 32: LED Duty Cycle States**

Status LED	Cycle
Mostly Off	One short blink ON every 2 seconds
Mostly On	One short blink OFF every 2 seconds
50%	ON and OFF blinking same amount of time; ½ second cycle
Rapid Flash	Strobe

Table 33: Status LED Explanations

Status LED	Description	Explanation
Mostly Off	Offline	Everything is OK within the QSNAP and the QSNAP is not being scanned. Check that the D77B-DNA is commanded to scan QCPort. To do this, set bit 0 of byte 0, for channel A, in the output assembly.
Mostly On	Online	Everything is OK within the QSNAP and the QSNAP is being scanned.
50% On	Faulted	Internal memory fault (cycle power) Verify that there are no duplicate Group IDs (addresses). Check that the address is unique for the QCPort system. The Group ID was changed and requires a reset. Buss fault. All the devices on the QCPort have the same status LED behavior. A buss fault is caused by an open or shorted buss.
Rapid Flash	Unacquired	The QSNAP has not been discovered/acquired by the Network Adapter. Verify that the node ID is set correctly for the system. The Network Adapter has not auto configured the QCPort system. In this case, all the QSNAPs have the same behavior as the status LED. Perform an auto configuration. CH Studio is identifying that bucket. When the bucket is highlighted in CH Studio, you can identify the field in which the bucket is highlighted. Remove the highlight from CH Studio and verify that the Rapid Flash disappears.
Solid On		It is possible the QSNAP is in firmware download mode. Cycle power to exit that mode. If the LED stays solid On after the power cycle, the QSNAP may be a non communicating QSNAP or the memory is corrupt.
Off	No Power	The QSNAP is not powered or a memory fault in NV RAM occurred that requires you to replace the QSNAP.
LED is Green	Not faulted	
LED is Red	Faulted	
LED is Amber	Warning	Device is in a warning state.

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Communication Hints

Table 34: Communication Hints

Problem	Solution
Are all the D77B-QSNAP's connected to one Network Gateway not communicating? Are all the Status LED's either Rapid Flash or 50% On	Check the Network Adapter. Is the ST LED Green? If the LED is green, perform an auto configuration of the Network Adapter and see if the problem goes away. There may be a damaged D77B-QSNAP or a shorted QCPort interconnect that is prohibiting QCPort from working. Use the divide and conquer rule: Split the QCPort in two by disconnecting the QCPort interconnect and cycle power to QCPort. If the D77B-QSNAPs from the Network Adapter to the split are working fine (LED is not in the faulted state), then add to the first half, half of the remaining units and test until the problem is discovered. If the D77B-QSNAPs from the Network Adapter to the split are <i>not</i> working fine (LED stays in faulted state), then split the QCPort in half again and test until the problem is found. It is possible that the terminating resistor located at the end of QCPort is not installed or working. Replace the terminating resistor. The terminating resistor will be D77E-TERRJ or D77E-QPLR.
Is there a single D77B-QSNAP in the MCC that is not communicating?	It is also possible the Group ID DIP switches were changed after auto configuration. Check the DIP switches and verify that they are in the correct position for that address. Physically move the DIP switch from one position to another to verify that it is in the correct position (there will be a "snap" when it reaches the ON or OFF state). Cycle power to the D77B-QSNAP and check that the problem disappears. It is possible that the Network Adapter is damaged. Replace the Network Adapter. It is possible that the terminating resistors are damaged. Replace the terminating resistors.
During auto configuration, the Network Adapter does not detect any of the D77B-QSNAPs.	Check the status LEDs on the D77B-QSNAPs. If the status LEDs are rapid flashing or 50% On, refer to the prior problem for a solution. If the status LEDs on the D77B-QSNAP units are all slow flashing, the Network Adapter has already connected to the D77B-QSNAP units and the problem is that the CH Studio software is not displaying the D77B-QSNAP units. The Network Adapter cannot perform an auto configuration if the system controller is scanning the Network Adapter. Disconnect the Network Adapter from the industrial network and reattempt the auto configuration.

Appendix A: Supported QCPort Object



CAUTION

The features described within this manual reflect D77B-QSNAPs with version 2.05 and greater.

Data Parameters

0x0001 (1) Production Data Supported in I/O - No
Size: Varies Description: This list contains the concatenated values of QCPort Parameters specified in QCPort Configuration Parameter 0x800C, Production List.
0x0002 (2) Consumption Data Supported in I/O - No
Size: Varies Description: This list contains the concatenated values of QCPort Parameters specified in QCPort Configuration Parameter 0x800D, Consumption List.
0x0003 (3) QCPort Status Supported in I/O - No
Size: 1 byte Description: This parameter indicates the QCPort fault condition that caused a device to enter the Fault Mode, as enumerated below: 0x00 - No QCPort Fault. 0x01 - Node ID Conflict. 0x02 - Invalid Node ID in Master/Slave. 0x03 - Physical Node ID does not match actual ID. 0x04 - Duplicate configured nodes online. 0x05 - Dynamic Node ID overflow. 0x06 - Invalid baud rate selected. 0x07 - Errant Device fault. 0x08 - Problem with data in non-volatile memory.
0x0004 (4) Application Status Supported in I/O - Yes
Size: 2 bytes Description: This parameter indicates the application status of the QCPort device. It reports the most recent fault or warning code. If there have been no faults or warnings, it reports 0. Reset clears this parameter.

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0x000B (11) 3-Wire Motor Control

Supported in I/O - Yes (Default Output Data)

Size:

1 byte

Description:

One byte comprised of 8 bits assigned as follows:

- 0 - Run1
- 1 - Run2
- 2 - Permissive
- 3 - Fault Reset
- 4 - Local Control Request (Not used in Master Slave mode)
- 5 - Reserved
- 6 - Reserved
- 7 - Reserved

0x000C (12) Motor Control Status

Supported in I/O - Yes (Default Input Data)

Size:

1 byte

Description:

One byte comprised of 8 bits assigned as follows:

- 0 - Running1
- 1 - Running2
- 2 - Permissive
- 3 - Reserved
- 4 - Device Under Local control
- 5 - Fault
- 6 - Warning
- 7 - At reference

0x000D (13) Motor Control Faults Supported in I/O - Yes (Default Input Data)
Size: 2 bytes Description: Two bytes comprised of 16 bits assigned as follows: Bit 0 - Phase Loss (Loss of one or more of the line phases) 1 - Phase Imbalance (current imbalance of greater than 50%) 2 - Thermal Overload (starter trip due to thermal overload) 3 - Reserved 4 - Breaker Fault 5 - Ground Fault (trip due to a ground fault, separate ground fault sensor required) 6 - Reserved 7 - Reserved 8 - Device Over Temperature (Device temperature limit exceeded, S75x only) 9 - Reserved 10 - Reserved 11 - Motor Control E-Stop (Device is in the state of an Emergency Stop) 12 - Reserved 13 - Reserved 14 - Reserved 15 - Other fault, see Fault and Warning Codes
0x000E (14) RMS AC Line Current (3 Φ ave) (% of FLA) Supported in I/O - Yes (Default Input Data)
Size: 2 bytes Description: A two byte number representing the average of the three RMS line currents in % FLA.
0x0012 (18) RMS AC Line Current (3 Φ average) (Amps) Supported in I/O - Yes
Size: 4 bytes Description: A four-byte IEEE floating-point number representing the average of the three RMS line currents in amps.
0x0016 (22) DC Control Voltage Supported in I/O - Yes
Size: 2 bytes Description: Two-byte number representing voltage in millivolts.

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0x0017 (23) Thermal Memory

Supported in I/O - Yes (Default Input Data)

Size:

1 byte

Description:

1 byte number representing thermal memory percent. Other terms for this parameter include thermal capacity and thermal pile.

0x001A (26) Fault QueueSupported in I/O - Yes⁷**Size:**

20 bytes

Description:

Faults are assigned numbers in the range 1 – 39,999. Warnings are assigned numbers 40,000 – 65,535. The fault queue is a chronological listing of the 10 most recent faults and warnings. Note that each new fault or warning replaces the previous most recent entry provided that it is a different number. Consecutive duplicate numbers should not occur. See Fault and Warning Codes

0x0023 (35) Motor Control Warnings

Supported in I/O - Yes

Size:

2 bytes

Description:

Two bytes comprised of 16 bits assigned as follows:

Bit

0 - Reserved

1 - Reserved

2 - Reserved

3 - Over Current (Device exceeded the over current threshold)

4 - Reserved

5 - Ground fault (Detection of a Ground Fault)

6 - Reserved

7 - Reserved

8 - Reserved

9 - Under Current (Device operating less than the lower current threshold)

10 - Impending Trip (running current greater than 115% of FLA)

11 - Motor Control E-Stop (Device is in the state of an Emergency Stop)

12 - Reserved

13 - Reserved

14 - Reserved

15 - Other fault, see Fault and Warning Codes

0x0029 (41) Ave Power Pole Temperature

Supported in I/O - Yes

Size:

2 bytes

Description:

Signed 16 bit integer representing the average power pole temperature in tenths of a °C.

0x0057 (87) Compressed Production Data

Supported in I/O - Yes

Size: 1 byte**Description:**

A short version of all the important bits provided by the D77B-QSNAP.

Bit

- 0 - Phase Loss (True when a phase loss is detected in the overload or a circuit breaker trip is active.)
- 1 - Phase Imbalance (True when a phase imbalance is detected in the overload.)
- 2 - Thermal Overload (True when a thermal overload occurred in the overload.)
- 3 - Under Current Warning (True when the running current is less than the low current warning level.)
- 4 - Ground Fault (Detection of a Ground Fault)
- 5 - No E-Stop (False when there is an E-Stop.)
- 6 - Over Current Warning (True when device exceeded the over current threshold.)
- 7 - Aux 1 Input Status (True when contractor is open.)

0x0058 (88) RMS Average Scaled Current (milli Amp)

Supported in I/O - Yes

Size: 2 bytes**Description:**

RMS Average current scaled to 0.001 amps:

A two-byte value for the RMS average current of the motor controller.

A value of 65536 = 65.536A.

0x0059 (89) RMS Average Scaled Current (centi Amp)

Supported in I/O - Yes

Size: 2 bytes**Description:**

RMS Average current scaled to 0.01 amps:

A two-byte value for the RMS average current of the motor controller.

A value of 65536 = 655.36A.

0x005A (90) RMS Average Scaled Current (deci Amp)

Supported in I/O - Yes

Size: 2 bytes**Description:**

RMS Average current scaled to 0.1 amps:

A two-byte value for the RMS average current of the motor controller.

A value of 65536 = 6553.6A.

0x005B (91) RMS Average Current (amps)

Supported in I/O - Yes

Size: 2 bytes**Description:**

RMS Average current:

A two-byte value for the RMS average current of the motor controller.

A value of 65536 = 65536A.

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0x005C (92) Field Wiring Status

Supported in I/O - Yes

Size: 1 byte**Description:**

Provides feedback of all the device specific inputs on the cover control:

- 0 - HOA Run1 - Run 1 command from HOA is true
- 1 - HOA Run2 - Run 2 command from HOA is true
- 2 - HOA Reset - Reset on HOA is true
- 3 - HOA Hand/Auto - Hand is true, Auto is false
- 4 - Aux 1 - Open is true
- 5 - Aux 2 - Open is true
- 6 - Contactor Closed - Primary contactor is closed
- 7 - No E-Stop - No E-Stop, true when in E-Stop

0x006A (106) 2-Wire Motor Control

Supported in I/O - Yes

Size: 1 byte**Description:**

One byte comprised of 8 bits assigned as follows:

- 0 - Run1
- 1 - Run2
- 2 - Reserved
- 3 - Fault Reset
- 4 - Local Control Request (Not used in Master Slave mode)
- 5 - Reserved
- 6 - Reserved
- 7 - Reserved

Configuration Parameters

None of the Configuration Parameters support I/O data.

0x8001 (32769) Device Identity		
Size: 14 bytes Default: See below Description: This read-only parameter contains information that uniquely identifies a device, including the following elements:		
Product Code (2 bytes)	0x8107	
Vendor ID (2 bytes)	0x0001	
Serial Number (4 bytes)	A device's serial number shall be reported. This value shall be unique for a particular manufacturer across all device types.	
Hardware Revision (2 bytes)	Major revision shall be reported in the MSB. Minor revision shall be reported in the LSB	
Firmware Revision (2 bytes)	Major revision shall be reported in the MSB. Minor revision shall be reported in the LSB.	
QCPort Revision (2 bytes)	Major revision shall be reported in the MSB. Minor revision shall be reported in the LSB.	
0x8002 (32770) Configuration CRC		
Size: 2 bytes Default: N/A Description: Used for confirmation of a device's configuration. Normally, the initial values of selected configuration parameters would be included in the calculation. The product instruction leaflet should describe which parameters are actually included. To facilitate node replacement, Device Identity information should not be included in this calculation.		
0x8003 (32771) Node ID		
Size: 2 bytes Default: 0x0000 Description: This parameter specifies a device's Node ID. The Group ID is the Most Significant Byte and the Member ID is the Least Significant Byte. An Initial Value of 0x0000 indicates an unconfigured state. In this state, a device shall assume a current value based on the level of switch support implemented in hardware.		
0x8004 (32772) Operating Mode		
Size: 1 byte Default: 0x00 Description: This parameter specifies a device’s operating mode, as follows:		
Mode	Description	Active/Passive
0x00	Unconfigured	Passive
0x01	Simple System	Passive
0x02	Master/Slave	Active
0x03	Wire Replacer	Passive
0x04	Faulted	Passive

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0x8005 (32773) Baud Rate**Size:** 1 byte**Default:** 0x03**Description:**

This parameter specifies the QCPort baud rate for a device as indicated below:

0x00 - 9600

0x01 - 19,200

0x02 - 38,400

0x03 - 57,600

0x04 - 115,200

0x05 - 230,400

0x06 - 460,800

Note that the current value of the baud rate cannot be directly modified. The current value is set to the initial value upon reset. Therefore, writing to the initial value and resetting the device sets a new current value.

0x8006 (32774) Slave Address**Size:** 1 byte**Default:** 0x00**Description:**

This parameter specifies the address used by a Master for data transfers in the Master/Slave Data Protocol.

The default value shall be 0x00 (unconfigured), requiring a Master to set this value prior to use of the Master/Slave Data Protocol.

0x8007 (32775) Production Destination**Size:** 2 bytes**Default:** 0x0000**Description:**

This parameter specifies the destination Node ID a device should use in either the Simple System or Wire Replacer Data Protocols. The MSB indicates the Group ID; the LSB indicates the Member ID.

An Initial Value of 0x0000 indicates an unconfigured state. In this state, a device assumes a current value equal to its Group ID and a Member ID of 0x00. This results in its Production Data being targeted at all members of its Group.

0x8008 (32776) Device ID Tag**Size:** 32 bytes**Default:** QCPort Cover Control**Description:**

This parameter specifies the 32-character ASCII string ID tag assigned to a device, pre-assigned at the factory but settable by the user.

0x8009 (32777) Production Interval**Size:** 2 bytes**Default:** 50**Description:**

This parameter specifies the rate, in milliseconds, at which a producing device generates a Data Protocol message in either Simple System or Wire Replacer mode.

A value of 0 disables this timer.

0x800A (32778) Consumption Interval Size: 2 bytes Default: 2000 Description: This parameter is the value to which the consumption timer is set whenever there is a set of the current value of any parameter on the consumption list. Expiration of this interval causes the module to execute communications loss behavior. A value of 0 disables this timer.
0x800B (32779) Parameter List Size: 104 bytes Default: N/A Description: This read-only list specifies the n QCPort Parameters that a device supports.
0x800C (32780) Production List Size: 2 bytes Default: 0x000C, 0x000D, 0x000E, 0x0017 Description: This 2xn-byte read-only list specifies the n QCPort Parameters included in a device's QCPort Data Parameter 0x0001, Production Data. Setting Parameter Attribute 0x09, "Production List Member," to TRUE designates a Parameter's membership in this list. Only Parameters supporting Attribute 0x09 are eligible for inclusion in this list. Ordering of Parameter IDs in the Production List is based first on Parameter data size, and then, sequentially within Parameters of like size. For example, all Parameters with an even number of bytes would appear first sequentially, followed by Parameters with an odd number of bytes.
0x800D (32781) Consumption List Size: 2 bytes Default: 0x000B Description: This 2xn-byte read-only list specifies the n QCPort Parameters included in a device's QCPort Data Parameter 0x0002, Consumption Data. Setting Parameter Attribute 0x0A, "Consumption List Member," to TRUE designates a Parameter's membership in this list. Only Parameters supporting Attribute 0x0A are eligible for inclusion in this list. Ordering of Parameter IDs in the Consumption List is based first on Parameter data size and then, sequentially, within Parameters of like size. For example, Parameters with an even number of bytes would appear first sequentially, followed by Parameters with an odd number of bytes.
0x800E (32782) Languages Supported Size: n bytes Default: N/A Description: This is a list of languages supported in the product. It consists of a list of bytes, each representing a different language. 0x00 English 0x01 Spanish 0x02 French 0x03 German 0x04 Italian

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0x800F (32783) Language Selection**Size:** 1 byte**Default:** 0x00**Description:**

Holds the currently selected language from the list in parameter 800E.

0x8010 (32784) Device Semaphore**Size:** 4 bytes**Default:** N/A**Description:**

The purpose of this parameter is to provide a method for tools to access a QCPort node in a non-conflicting manner. This parameter consists of a field of 2 Units organized as follows:

Byte

Node ID Low byte

Node ID High byte

Lockout Time in tenths of seconds Low byte

Lockout Time in tenths of seconds High byte

If the above 4 bytes are 0, anyone can write to this parameter. This parameter cleared by the Clear Semaphore command that can be sent by anyone. If all 4 bytes are not 0 and a write (other than a clear) to this parameter is attempted, an error message is returned. The parameter is cleared when the timer counts down to 0.

If the node ID field is 0, all set parameters to the node are accepted. If the node ID field is not 0, set parameter commands to the node are only accepted from the device having the same node ID as that contained in this parameter.

Note that if the node ID is set to zero at the same time that a non-zero value is loaded to the timer, the timer does not decrement.

0x8020 (32800) Overload Trip FLA Value**Size:** 4 bytes**Default:** N/A**Description:**

IEEE floating point value of Full Load Amps (FLA) in amps.

0x8021 (32801) Overload Trip Class Value**Size:** 1 byte**Default:** N/A**Description:**

Motor trip class.

0x8022 (32802) Percent Initial Torque**Size:** 1 byte**Default:** N/A**Description:**

This parameter is intended for use primarily with a soft starter. It consists of a single byte that specifies the starter's initial torque in percent.

0x8025 (32805) Motor Start Ramp Time**Size:** 2 bytes**Default:** N/A**Description:**

Used primarily with soft starters, defines the duration of the start ramp in tenths of a second.

0x8026 (32806) Motor Stop Ramp Time**Size:** 2 bytes**Default:** N/A**Description:**

Used primarily with soft starters; defines the duration of the stop ramp in tenths of a second.

0x802B (32811) Motor Over Current Warning Enable**Size:** 1 byte**Default:** Enabled**Description:**

Enables/disables the over current warning.

0x802C (32812) Motor Over Current Warning Level (% FLA)**Size:** 2 bytes**Default:** 150**Description:**

The minimum level of current (as a percent of FLA) that must exist for the over current warning duration to cause an over current warning.

A product may use either 0x802C or 0x802D, but not both.

0x8033 (32819) Motor Under Load Warning Enable**Size:** 1 bytes**Default:** Disabled**Description:**

Enables/disables the under load warning.

0x8034 (32820) Motor Under Load Warning Level (% FLA)**Size:** 1 bytes**Default:** 0**Description:**

The maximum level of current (as a percent of FLA) that must exist for the under load warning duration to cause an under load warning.

0x8037 (36823) Ground Fault Enable**Size:** 1 bytes**Default:** Enabled**Description:**

Enables/disables ground fault detection.

0x8038 (32824) Ground Fault Duration**Size:** 2 bytes**Default:** 100**Description:**

The length of time, in thousandths of a second, for which a ground fault condition must exist to cause a ground fault.

0x803A (32826) Ground Fault Inhibit From Start Delay**Size:** 2 bytes**Default:** 100**Description:**

The length of time, in hundredths of a second, that must elapse after a start before a ground fault is recognized.

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0x804D (32845) Physical Node ID setting**Size:** 2 bytes**Default:** 0x00**Description:**

This parameter may be used with modules having a hardware node ID switch and represents the actual setting of that switch.

0x804E (32846) Motor Communication Loss Action**Size:** 1 byte**Default:** 0x00**Description:**

Determines motor action in the event of a communications timeout in network communications. Note that this parameter only applies when the node is on line and in Auto mode. The following values are allowed:

0x00 = Auto Stop - go to auto and stop

0x01 = Auto Run1 - go to auto and Run1

0x02 = Auto Run2 - go to auto and Run2

0x03 = Hold Last - hold last state

0x07 = All Stop - leaves in last control mode (local or auto) and stop

Note: All Stop causes a fault and needs a reset to clear.

Data Registers

None of the Data Registers are support I/O data.

Register 1; Overload Device Type

Size: 1 Byte, Read only

Default: N/A

Description:

Upper Nibble	Lower Nibble
00 - Reserved	00 - Reserved
01 - Contactor	01 - 27 mm
02 - Remote IT Overload	02 - 45 mm
03 - IT Starter	03 - 54 mm
04 - Reserved	04 - 76 mm
05 - Reserved	05 - 105 mm
06 - Micro Soft Starter	06 - 140 mm
07 - Reserved	07 - Reserved

Register 2; Overload Serial Number

Size: 4 Bytes, Read only

Default: N/A

Description:

Serial number scheme abides by the DeviceNet rules.

Register 3; Overload Firmware Revision

Size: 2 Bytes, Read only

Default: N/A

Description:

Code version utilizes Cutler-Hammer's method of revision control.

Register 4; S75x Soft Starter Device Type

Size: 1 Byte, Read only

Default: N/A

Description:

Upper Nibble	Lower Nibble
00 - Reserved	00 - Reserved
01 - Reserved	01 - Reserved
02 - Reserved	02 - Reserved
03 - Reserved	03 - 54 mm
04 - Reserved	04 - Reserved
05 - Reserved	05 - Reserved
06 - Micro Soft Starter	06 - Reserved
07 - Reserved	07 - Reserved

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Register 5; S75x Soft Starter Firmware Revision**Size:** 2 Bytes, Read only**Default:** N/A**Description:**

Code version utilizes Cutler-Hammer's method of revision control.

Register 6; Number of Contactors**Size:** One Byte, Read only**Default:** N/A**Description:**

Bit 0: Contactor controlled by Run1 present.

Bit 1: Contactor controlled by Run2 present.

Note: If a Run1 contactor is not detected, a warning will be issued

Register 7; QSNAP Serial Number**Size:** 4 Bytes, Read Only**Default:** N/A**Description:**

This register holds the serial number for this node.

Register 8; Field Inputs**Size:** 1 Byte, Read Only**Default:** N/A**Description:**

Bit

- | | |
|---|---|
| 0 | HOA Run 1 - sets when enabled |
| 1 | HOA Run 2 - sets when enabled |
| 2 | Hand/Auto - Hand = 1, Auto = 0 |
| 3 | HOA Reset - sets when enabled |
| 4 | E-Stop - 1 = E-Stop input is open |
| 5 | GND Fault - 1 = GND Fault input is open |
| 6 | Reserved |
| 7 | Reserved |

Register 9; Field Outputs**Size:** 1 Byte, Read Only**Default:** N/A**Description:**

Bit

- | | |
|---|--------------|
| 0 | Alarm Output |
|---|--------------|

Register 10; Hardware Enablers Size: 1 Byte, Read Only Default: N/A Description: Bit 0 Ground Fault, 1 Reserved
Register 11; Total Run1 State Changes Size: UINT32, Read Only Default: N/A Description: Total number of Run1 commands executed.
Register 12; Total Run2 State Changes Size: UINT32, Read Only Default: N/A Description: Total number of Run2 commands executed.
Register 15; Firmware Revision Number Size: 3 bytes, Read Only Default: N/A Description: The format will be XX.YY.ZZ where XX is the major revision, YY is the minor revision and ZZ is the minor minor revision. The data is low byte first (ZZ).
Register 16; E-Stop Reset Mode Select Size: 1 byte, Read Write Default: 0 Description: Setting of this register to a 1 enables the requirement for a reset (keypad, remote or network) to activate after an E-Stop to clear the fault <i>E-Stop Fault</i> (54). The default for this register is 0, which activates a warning, <i>E-Stop Warning</i> (40013). This warning self clears after the E-Stop is removed.
Register 26; Disable Starter Communications Size: 1 byte, Read Write Default: 0 Description: Setting of this register to 1 disables the communications between the QSNAP and the IT Starter. Use this when the QSNAP is connected to an IT Contactor.
Register 27; Aux Input Behavior Size: 1 byte, Read Write Default: 0 Description: Bit 0 - Disable Aux 1 input (Run 2) to use as a general purpose input 1 - Disable Aux 2 input (Ground Fault) to use as a general purpose input

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Register 28; % FLA Log Interval**Size:** UNIT, Read Write**Default:** 0**Description:**

This register controls the sample interval set in seconds for logging of % FLA. A setting of 0 disables logging. You can set the interval from 1 to 65534 seconds. By default, the setting is disabled (0).

Register 29; % FLA Log**Size:** Array of bytes, Read Only**Default:** 0**Description:**

This register contains the log of % FLA.

Register 31; Thermal Memory Interval**Size:** UNIT, Read Write**Default:** 0**Description:**

This register controls the sample interval set in seconds for logging of Thermal Memory. A setting of 0 disables logging. You can set the interval from 1 to 65534 seconds. By default, the setting is disabled (0).

Register 32; Thermal Memory Log**Size:** Array of bytes, Read Only**Default:** 0**Description:**

This register contains the log of Thermal Memory.

IT. Publications and Support

Table 35: IT. Publications

Publication	Description
Pub 50345	D77B-QSNAP Install Leaflet
Pub 50368	D77B-HOA8 Install Leaflet
MN05004001E	IT. QCPort Starter Network Adapter Product (D77B-QSNAP) Installation and Users Manual
Pub 49907	Intelligent Technologies S75x Soft Starter User Manual
MN03403002E	IEC Contactor and Starter User Manual
MN03305001E	NEMA Contactor and Starter User Manual

For copies of these and other publications, contact the Literature Fulfillment Center at 1-800-957-7050.

Company Information

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Publication No. MN05001001E
June 2005
Printed in USA