User Manual for
HE800JCM205

SmartStack SAE J1939 Communication Module

03 December 2002 **MAN0546-03**

PREFACE

This manual explains how to use SmartStack SAE J1939 Communication Modules.

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To obtain warranty service, return the product to your distributor with a description of the problem, proof of purchase, post paid, insured and in a suitable package.

ABOUT PROGRAMMING EXAMPLES

Any example programs and program segments in this manual or provided on accompanying diskettes are included solely for illustrative purposes. Due to the many variables and requirements associated with any particular installation, Horner APG cannot assume responsibility or liability for actual use based on the examples and diagrams. It is the sole responsibility of the system designer utilizing the SmartStack SAE J1939 Communication Module to appropriately design the end system, to appropriately integrate the SmartStack SAE J1939 Communication Module and to make safety provisions for the end equipment as is usual and customary in industrial applications as defined in any codes or standards which apply.

Note: The programming examples shown in this manual are for illustrative purposes only. Proper machine operation is the sole responsibility of the system integrator.

REVISIONS TO THIS MANUAL

1. Revised module operation (Chapter 2).

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CHAPTER 1: INTRODUCTION

1.1 Overview

The HE800JCM205 is a SmartStack SAE J1939 Communication Module. SAE J1939 (J1939) is a CAN-based protocol used in truck and bus control communications networks. There are various layers to the J1939 protocol that are described in SAE J1939 documents. J1939 uses a 29-bit identifier requiring hardware that can support CAN 2.0B. The baud rate is fixed at 250Kbps. SAE J1939 specifies a table of Parameter Group Numbers (PGNs). A PGN is unique numeric identifier that is associated with a specific parameter name. A PGN is used to define the parameter value a device is requesting or the parameter value that a device is sending.

Note: SAE is an acronym for *Society of Automotive Engineers.*

1.2 Product Description

There are 2 operational bi-colored LEDs on the side of the module. One LED is green indicating the module is OK. The other LED flashes orange, indicating network traffic.

1.3 Functional Description

The JCM205 can request/monitor data from and transmit data to devices on the J1939 network. There are 10 receive buffers and 10 transmit buffers that can be configured for handling data. The configuration is accomplished using PLC registers and ladder logic. This allows for “on-the-fly” configuration changes. For detailed information, refer to Chapter 2: Operation.

1.4 Technical Support

For assistance, contact Technical Support at the following locations:

North America:
(317) 916-4274
www.heapg.com

Europe:
(+) 353-21-4321-266
www.horner-apg.com

CHAPTER 2: OPERATION

2.1 General

Chapter Two covers operational information for the JCM205.

2.2 Two Communication Methods for Handling Data

The JCM205 can request and monitor data from and transmit data to devices on the J1939 network. There are two communication methods used for handling data. The first method is *Scanning* in which Parameter Group Numbers (PGNs) are loaded into up to 10 receive tables, and the module continuously gathers data for the configured PGNs. The second method is a *Timed Transmit* in which up to 10 transmit tables are configured to send a message every X number of milliseconds. The following sections cover each communication method in detail.

2.3 Register Definitions

Both communication methods share the same AQ registers for configuring the receive and transmit tables. Some of the AQ register definitions change for the two buffers.

A total of 14 %AQs, 16 %Qs and 32 %Is are used for the configuration and module operation. The starting locations are configured through the I/O configuration in Cscape. The total number of %R registers used will vary depending on the configured tables.

Table 2.1 - %AQ Definitions for Receive Table

%AQ Register	Description
AQx	Table Number (0-9)
AQx+1	Source Address (0-255)
AQx+2	PGN (PF & PS)
AQx+3	Priority (0-7)
AQx+4	Number of bytes
AQx+5	Scan Method (0=Monitor 1=Request)
AQx+6	Starting %R register to store data
AQx+7	Not Used
AQx+8	Not Used
AQx+9	Not Used
AQx+10	Not Used
AQx+11	Not Used
AQx+12	Not Used
AQx+13	Not Used

Table 2.2 - %AQ Definitions for Transmit Table

%AQ Register	Description
AQx	Table Number (0-9)
AQx+1	Source Address (0-255)
AQx+2	PGN (PF & PS)
AQx+3	Priority (0-7)
AQx+4	Number of bytes
AQx+5	Time Interval in milliseconds
AQx+6	Transmit data Byte 1
AQx+7	Transmit data Byte 2
AQx+8	Transmit data Byte 3
AQx+9	Transmit data Byte 4
AQx+10	Transmit data Byte 5
AQx+11	Transmit data Byte 6
AQx+12	Transmit data Byte 7
AQx+13	Transmit data Byte 8

Table 2.3 - %Q Definitions	
%Q Register	**Description**
Qx	TX Data Buffer 0 Update
Qx+1	TX Data Buffer 1 Update
Qx+2	TX Data Buffer 2 Update
Qx+3	TX Data Buffer 3 Update
Qx+4	TX Data Buffer 4 Update
Qx+5	TX Data Buffer 5 Update
Qx+6	TX Data Buffer 6 Update
Qx+7	TX Data Buffer 7 Update
Qx+8	TX Data Buffer 8 Update
Qx+9	TX Data Buffer 9 Update
Qx+10	Spare
Qx+11	Spare
Qx+12	Spare
Qx+13	Spare
Qx+14	RX Table Update
Qx+15	TX Table Update

Table 2.4 - %I Definitions	
%I Register	**Description**
Ix	TX Data Buffer 0 Update Ack
Ix+1	TX Data Buffer 1 Update Ack
Ix+2	TX Data Buffer 2 Update Ack
Ix+3	TX Data Buffer 3 Update Ack
Ix+4	TX Data Buffer 4 Update Ack
Ix+5	TX Data Buffer 5 Update Ack
Ix+6	TX Data Buffer 6 Update Ack
Ix+7	TX Data Buffer 7 Update Ack
Ix+8	TX Data Buffer 8 Update Ack
Ix+9	TX Data Buffer 9 Update Ack
Ix+10	Spare
Ix+11	No RX Timeout
Ix+12	Bus Off Error
Ix+13	Power Fail Error
Ix+14	RX Table Update Ack
Ix+15	TX Table Update Ack
Ix+16	TX Data Buffer 0 Update Error
Ix+17	TX Data Buffer 1 Update Error
Ix+18	TX Data Buffer 2 Update Error
Ix+19	TX Data Buffer 3 Update Error
Ix+20	TX Data Buffer 4 Update Error
Ix+21	TX Data Buffer 5 Update Error
Ix+22	TX Data Buffer 6 Update Error
Ix+23	TX Data Buffer 7 Update Error
Ix+24	TX Data Buffer 8 Update Error
Ix+25	TX Data Buffer 9 Update Error
Ix+26	Spare
Ix+27	Spare
Ix+28	Spare
Ix+29	Spare
Ix+30	RX Table Update Error
Ix+31	TX Table Update Error

2.4 Scanning

The Scanning method uses a scan table that contains a series of PGNs and associated information. Data for the configured PGNs is continuously gathered and sent to the PLC. There are two modes for gathering data from devices on the J1939 network, monitor and request. Each PGN in the scan table is configured to use one of the two modes for gathering data. The JCM205 does not know which PGNs require monitoring and which PGNs require requesting; it is the responsibility of the individual configuring the module to enter the information. Otherwise, the data may not be updated.

a. Monitor Mode

An engine control module (ECM) sends some PGN data onto the network at regular intervals. The specific PGNs that are sent vary between ECMs. If the ECM broadcasts a desired PGN's data on a regular basis, then the mode for that PGN is configured for monitor.

Monitoring does not require interaction between the JCM205 and a device on the network. The JCM205 monitors the network for the PGNs that are configured as monitor mode in the scan table. If it finds a match, then the data is sent to the PLC. In this mode, the source address is not used.

b. Request Mode

If the desired PGN is not sent on a regular basis, then a request must be made from the JCM205 to the device *before* the data is sent. The mode for these PGNs are configured for request.

Requesting requires interaction between the JCM205 and a device on the network. The JCM205 must send a request message to a device onto the network and receive a reply *before* that data can be sent to the PLC. In this mode, the source address is required.

2.4.1 Receive Table Configuration

The receive table is configured by loading the AQ registers with the correct scan information and setting the RX Table Update bit (Qx+14). The JCM205 copies the information from the AQ registers into the corresponding receive table when the RX Table Update bit transitions from a 0 to 1. The RX Table Update Ack bit (Ix+14) is set when the JCM205 finishes updating the table. If an error occurs then the RX Table Update Error bit will also be set Otherwise, it will be clear indicating that there were no errors in data stored in the table.

REGISTER DEFINITIONS:
Buffer Number (0-9) – JCM205 receive table number in which to load the scan information.
Source Address (0-255) – Source address used when requesting data. It is not used for monitoring data. (Part of the ID value)
PGN [PF & PS] (0-65535) – Predefined number in the SAE documents associated with the specific parameter that is to monitored. (Part of the ID value)
Priority (0-7) – Arbitration Priority where 0 is highest and 7 is lowest. (Part of the ID value)
Number of Bytes – Number of bytes expected
Scan Method (0 or 1) – 0=Monitor and 1=Request
Starting %R Register – Starting %R register that will contain the first byte of received data. Subsequent %R registers will contain the remaining bytes of data up to the Number of Bytes.

EXAMPLE:
In the following example, all registers start at 1 (%Q1, %AQ1, %I1). Eight bytes of Electronic Engine Controller #1 data is broadcast on the network so the receive table will be configured to monitor for the data.

1) Load the %AQ registers:
   AQ1: 5 (Using buffer number 5)
   AQ2: 251 (Extra source address area, not used for monitoring)
   AQ3: 61444 (PGN for Electronic Engine Controller #1)
   AQ4: 7 (Lowest priority, not used for monitoring)
   AQ5: 8 (8 bytes of data)
   AQ6: 0 (Monitor)
   AQ7: 100 (Recevied data will start at %R100)

2) Transition %Q15 from 0 to 1 (RX Table Update bit)
3) Wait for %I15 to go to 1
4) Check %I31:
   I31 = 0 – Table update was successful
   I31 = 1 – Table updated fail (On or more %AQ data out of range)
5) Transitions %Q15 from 1 to 0
6) %I15 and %I31 clear

RESULT:
%R100-%R107 will contain the data received for PGN 61444.

The same procedure is used to update receive tables 0-9. Any one of the receive tables can be updated at anytime.

2.5 Timed Transmit – Table

The transmit table is configured by loading the AQ registers with the correct scan information and setting the TX Table Update bit (Qx+15). The JCM205 copies the information from the AQ registers into the corresponding transmit table and the data from the configured %R registers when the TX Table Update bit transitions from a 0 to 1. Note that both the transmit table and trasmit data are updated. The TX Table Update Ack bit (Ix+15) is set when the JCM205 finishes updating the table. If an error occurs then the TX Table Update Error bit will also be set Otherwise, it will be clear indicating that there were no errors in data stored in the table.

REGISTER DEFINITIONS:
Buffer Number (0-9) – JCM205 transmit table number in which to load the scan information.
Source Address (0-255) – Source address used when transmitting data. It is not used for monitoring data. (Part of the ID value)
PGN [PF & PS] (0-65535) – Predefined number in the SAE documents associated with the specific parameter that is to sent. (Part of the ID value)
Priority (0-7) – Arbitration Priority where 0 is highest and 7 is lowest. (Part of the ID value)
Number of Bytes (1-8) – Number of bytes to load into the transmit buffer (8 bytes are always sent)
Time Interval (0, 15-60000) – Number of milliseconds between transmits. 0=stop transmitting
Transmit data – Registers that contain the transmit data to load in to the transmit data buffer

EXAMPLE:
In the following example, all registers start at 1 (%Q1, %AQ1, %I1). Eight bytes of Electronic Engine Controller #1 data is broadcast on the network so the transmit table will be configured to send the data every 50ms.

1) Load the %AQ registers:
   AQ1: 5 (Using buffer number 5)
   AQ2: 251 (Source address)
   AQ3: 61444 (PGN for Electronic Engine Controller #1)
   AQ4: 7 (Lowest priority, not used for monitoring)
   AQ5: 8 (8 bytes of data)
   AQ6: 50 (50ms)
   AQ7: 00 (Start of Transmit data)
   AQ8: 11
   AQ9: 22
   AQ10: 33
   AQ11: 44
   AQ12: 55
   AQ13: 66
   AQ14: 77

2) Transition %Q16 from 0 to 1 (TX Table Update bit)
3) Wait for %I16 to go to 1
4) Check %I32:
   I32 = 0 – Table update was successful
   I32 = 1 – Table updated fail (On or more %AQ data out of range)
5) Transitions %Q16 from 1 to 0
6) %I16 and %I32 clear

RESULT:
The transmit table 5 will be updated to send data that was stored in %R200-%R207 for PGN 61444 every 50ms.

The same procedure is used to update transmit tables 0-9. Any one of the transmit tables can be updated at anytime.

2.6 Timed Transmit – Data

The transmit table is configured by loading the AQ registers with the correct scan information and setting the TX Table Update bit (Qx+15). The JCM205 copies the information from the AQ registers into the corresponding transmit table and data table when the TX Table Update bit transitions from a 0 to 1. Note that both the transmit table and trasmit data are updated. The TX Table Update Ack bit (Ix+15) is set when the JCM205 finishes updating the table. If an error occurs then the TX Table Update Error bit will also be set Otherwise, it will be clear indicating that there were no errors in data stored in the table.

EXAMPLE:
In the following example, transmit table 5 has already been configured.

1) Load the %AQ registers with new data:
    AQ7: 00 (Start of Transmit data)
    AQ8: 11
    AQ9: 22
    AQ10: 33
    AQ11: 44
    AQ12: 55
    AQ13: 66
    AQ14: 77

2) Transition %Q5 from 0 to 1 (TX Data Buffer Update bit)
3) Wait for %I5 to go to 1
4) Check %I21:
    I21 = 0 – Data buffer update was successful
    I21 = 1 – Data buffer updated fail
5) Transitions %Q5 from 1 to 0
6) %I5 and %I21 clear

RESULT:
The transmit data buffer 5 will be updated with new data was stored in %AQ7-%AQ14.

CHAPTER 3: CONFIGURATION

3.1 General

Chapter Three covers the configuration of the JCM205. The purpose of the configuration is to allow communication between an OCS/RCS and an Engine Control Module.

Note: To perform this configuration, it is necessary to consult the engine manufacturer's user documentation to determine parameter numbers and the corresponding number of words for each parameter.

3.2 Configuration

a. First, invoke Cscape. From the Cscape Main Menu, select **Controller | I/O Configure…** .

Ensure the correct controller is selected. To change controllers, press **CPU Slots** and select the desired module.

You can add an I/O module to any slot, but Slot 1 must not be empty.

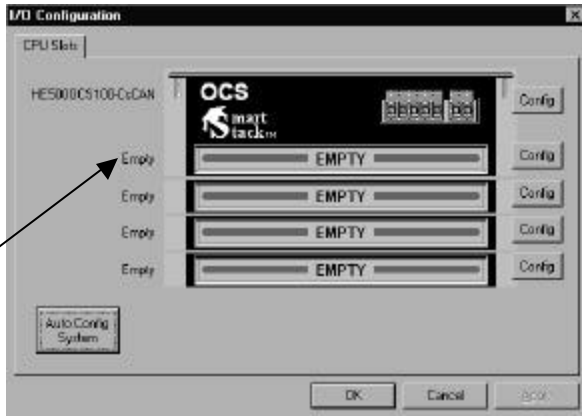

Figure 3.1 – Select the Module Slot

Ensure that the desired controller is selected. The OCS300-CsCAN is shown as the selected controller (Fig. 3.1) in this example. If satisfied with the controller selection, press a **Base #** tab, and go to Step 3. If a different controller is desired (as it is in this configuration example), continue Step 2.

Note: The **Auto Config System** button can be pressed *prior* to selecting the desired controller *and* I/O. By pressing the button, the settings are deleted from any controller *and* I/O that is physically connected to the PC. A dialog box appears and indicates that settings will be deleted from currently configured models. If OK, press **Yes**. Then press **OK**.

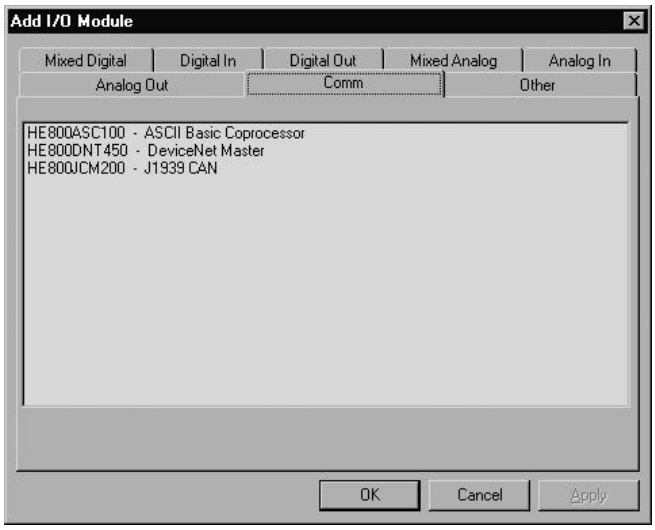

Figure 3.2 – Select the Comm tab

b. Next, double-click on the empty slot in which the JCM205 module will reside, or click on the **Config** button to the right of the slot position. This invokes the Add I/O Module screen. Click on the **Comm** tab.

From that dialog, select the **JCM205** module, and click **OK**.

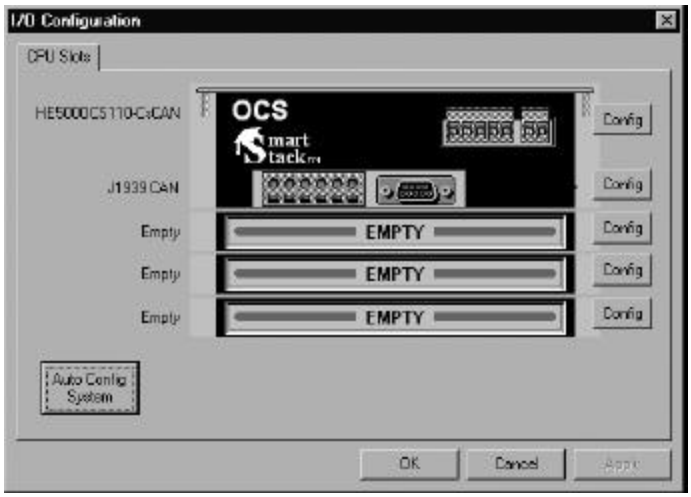

Figure 3.3 – JCM205 Module is Added

c. The screen returns to the Configure I/O dialog box - with the selected slot showing that the **JCM205** module has been added.

Double-click on the JCM205 module in the I/O configuration screen (Figure 3.3) or click on the **Config** button next to the JCM205 module.

d. The following screen appears: Two tabs are available for selection:

Figure 3.4 – Module Configuration

I/O Map Tab

NOTE: Ignore this screen at this point. The registers can be varied during configuration.

Module Setup Tab

The **Module Setup** screen has two important functions.

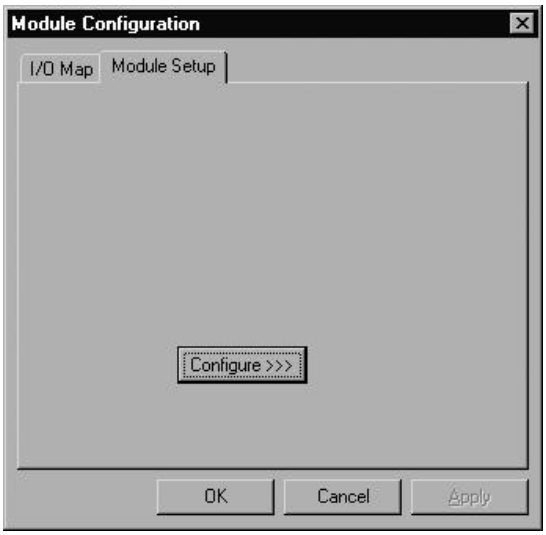

Figure 3.5 – Module Setup Tab

Function 1: Pressing the **Module Setup** tab displays a screen with a **Configure** button. Pressing the **Configure** button opens the following **Configurator** screen.

Function 2: After you finish with the **Configurator,** be sure to return to this screen and press **OK** (or **CANCEL**) to save (or cancel) all changes..

e. The following screen appears.

Register Entry focuses on 3 register types: %Q, %AQ, %I. These types have a fixed number of registers.

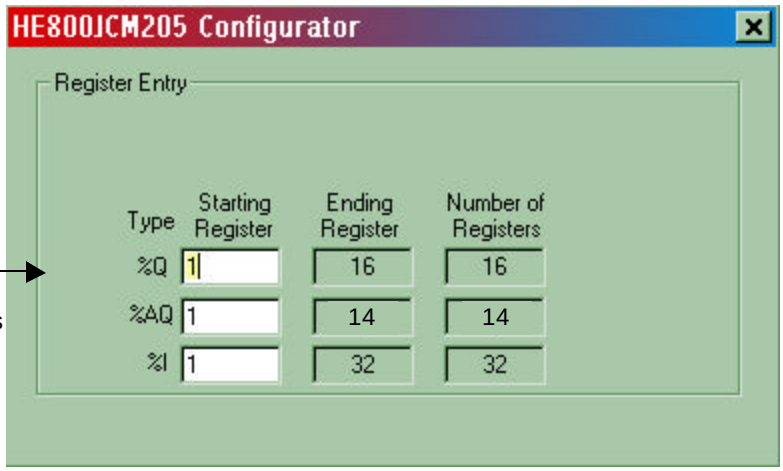

Figure 3.6 - JCM205 Configuration Program

Standard Configuration

The JCM205 has a fixed number of 16 %Qs, 32 %Is, and 14 %AQs.

Type: Displays the register types assigned to the module.

Starting Register: Denotes the starting location of the register type. **These are user-editable fields.**

Ending Register: Denotes the ending location of the register type. These fields are **automatically updated** by the Configurator.

Number: Indicates the quantity of a particular register type. These fields are **automatically updated** by the Configurator.

f. During the configuration, it is possible that the following screen appears. In the event that it does appear, press the HE800JCM205 Configurator button (located on the Menu bar at the very bottom of the screen) to return to the configuration screen. This screen simply prompts you to close the JCM205 editor to continue.

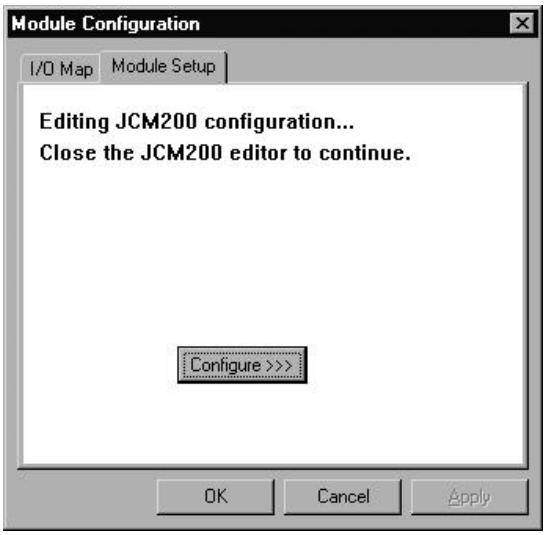

Figure 3.7 - PGN Configuration

g. You need to save the configuration changes by exiting the configuration screen (Click the X in the upper right corner) and then returning to the **Module Setup** screen.

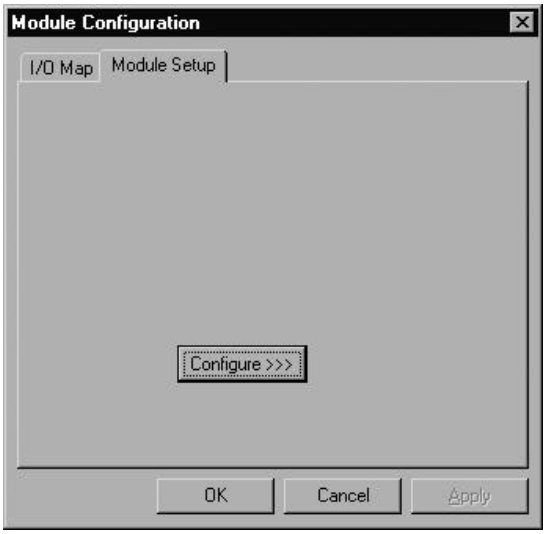

Figure 3.8 – Module Setup Tab

h. To save or cancel your settings, be sure to return to this screen and press **OK** or **CANCEL**.

NOTES