



Manual

Electronic Code Switch Module (ECS)

» Software Device Profile 1.3.0.0 «



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Read Instructions Carefully!

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1 — OVERVIEW

The Curtis Electronic Code Switch (ECS) is an operator identification keypad. The ECS ensures that only authorized users can operate a vehicle. The ECS supervisor defines the authorized users. Authorized users can log on by entering a user ID and PIN code or by swiping an RFID tag.

The ECS can be integrated into vehicle systems with or without a CANbus. The ECS is designed for use in applications such as material handling vehicles, MEWP (Mobile Elevating Work Platforms), golf carts, ICE vehicles, and many others.

The following list summarizes the ECS's key features:

- A Normally Open (NO) relay that is opened and closed by CAN messages or by users logging on and off.
- Machine power control through authorized RFID tag and PIN code access or CAN commands.
- Easy to integrate with vehicle systems:
 - **CAN-based systems:** CANopen implementation with an optionally connected CAN termination resistor. Supports CAN baud rates from 100 Kbps to 1 Mbps.
 - **Non-CAN systems:** The output relay changes state when an authorized user logs onto the ECS.
- Pass-through mode, which is for applications in which another CAN device can receive keypad entries and RFID tag swipes.
- Supports ISO 14443A RFID tags.
- Allows up to 100 users.
- Status LEDs and a buzzer confirm keypad entries and provide diagnostic information.
- Automatic log off based on the interlock state and a configurable timer.
- You can use the Curtis Integrated Toolkit™ (CIT) or the Curtis 1313 handheld programmer to change parameters, monitor real-time data, review and clear the fault history, update firmware, and perform other diagnostic and application development tasks.
- Operates in demanding conditions, with an operational temperature range of -40° to $+70^{\circ}$ C and electronic components sealed to IP65.
- CE compliance, UL recognition, FCC Certification, and ROHS 3 compliance ensure compatibility with global regulatory safety.
- FCC Radiation Exposure Statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference, and
- this device must accept any interference received, including interference that may cause undesired operation.

Any changes or modifications to this equipment not expressly approved by CURTIS may cause harmful interference and void the user's authority to operate the equipment.

Note: For technical support, contact the Curtis distributor or the Curtis sales and support office in your region.

USING THIS MANUAL

- Vehicle operators only need to read the following chapters:
 - [Keypad, LEDs, and Buzzer](#)
 - [User Operation](#)
- The ECS supervisor should also read the following chapters:
 - [The ECS Supervisor and Users](#)
 - [Supervisor Operation with the Keypad](#)
 - [Manage Users with Curtis Programming Devices](#)
- Users who install, configure, and troubleshoot the ECS should also read the chapters applicable to their tasks.

CONVENTIONS

The following topics describes terms and notations used in this manual.

Numeral System Notation

The following table describes how this manual denotes decimal, binary, and hexadecimal numbers.

Note: The letter *n* in the **Format** column represents a digit.

Numeral System	Format	Example
Decimal	Either of the following: <ul style="list-style-type: none"> • <i>nnn</i> • <i>nnnd</i> 	<ul style="list-style-type: none"> • 127 • 127d
Hexadecimal	Either of the following: <ul style="list-style-type: none"> • <i>nnnh</i> • <i>0xnnn</i> 	<ul style="list-style-type: none"> • 62Ah • 0x62A
Binary	<i>nnnb</i>	101b

In addition, some CANopen examples have hexadecimal values without notation. Those examples are formatted with a monospace font and with the bytes delimited by spaces, as shown in the following example:

```
21 FF 01 11 22 01 00 00
```



Miscellaneous Conventions

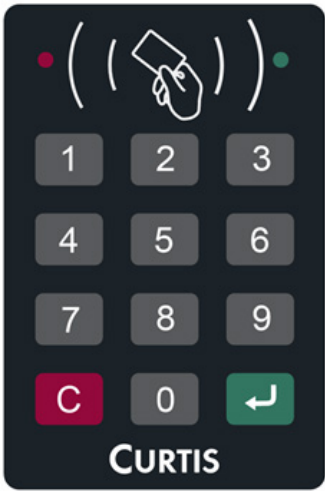
- *RO* means read-only.
- *RW* means read-write.
- *N/A* means not applicable.
- The word *tag* is used to describe RFID cards, keys, fobs, etc.




2 — KEYPAD, LEDs, AND BUZZER

The following topics describe the ECS’s keypad, LEDs, and buzzer.

KEYPAD

The ECS keypad consists of buttons for the numbers 0–9, as well as  and  buttons:




- The  button is used to submit entries. For example, press  after you enter a menu number.
- The  button is used to perform various tasks such as logging on and off, clearing data, and returning to the previous menu.

LEDs

The ECS has green and red LEDs that indicate information such as the current menu, status, and fault codes. The following table summarizes the typical usages of the LEDs:

ECS Operation	LEDs
The ECS is idle.	The green LED flashes once per two seconds and the red LED is off.
A user is logged on to operate the vehicle.	The red LED is off and the green LED remains on without flashing.
A fault occurs.	The LEDs flash the fault code. Faults typically are handled by a technician.
The supervisor is on the Supervisor Management menu or a user is on the User Management menu.	The red LED remains on without flashing and the green LED is off.
The supervisor or a user is working with a submenu of the Supervisor Management menu or User Management menu.	The information indicated by the LEDs depends upon the menu or submenu.








In this manual, LED flash sequences are described with tables that contain red and green circles. When an LED periodically flashes, the number of flashes are indicated with striped circles. In the following example, the red LED remains on without flashing and the green LED flashes twice per two seconds:

Red	Green
	

When an LED is off, the table will not include a circle for the LED.

BUZZER

The ECS has a buzzer that indicates whether user entries and RFID tag swipes are valid. The following table describes the buzzer sounds.

Sound	Description	Play Audio
Pushbutton	You pressed a button.	
Clear Data	You pressed  to clear data that you entered while working on a menu.	
Return	You pressed  to return to the previous menu or to log off.	
Error	You entered invalid data or an invalid menu number.	
Success	You logged on, entered valid data, or pressed a valid menu number.	

Note: If you don't hear the buzzer, it means that the Mute Enable parameter is set to On.


3 — USER OPERATION

The ECS ensures that only authorized users can access a vehicle. If you are authorized, the ECS supervisor will provide you with a user ID and PIN code, an RFID tag, or both.

The following sections describe how to use the ECS to operate a vehicle and to create or change your tag, PIN code, and/or user name code.

OPERATE A VEHICLE

To operate a vehicle equipped with the ECS, log on by taking one of the following steps:

- Place your user tag in front of the ECS.
- Enter your user ID and PIN code, then press .


Note: If your user ID is 1–9, enter 0 before the digit. For example, if the user ID is User 3, enter 03.

If your tag or your user ID and PIN code are valid, the buzzer sounds the [Success sound](#) and the green LED remains on without flashing. You can now operate the vehicle.

Red	Green
	

You remain logged on until you either log off, the interlock switch is off for longer than the programmed timeout interval, or another operator swipes a tag.

Once you have finished operating the vehicle, log off by pressing and holding  until you hear the [Return sound](#) and the green LED starts flashing.

Red	Green
	

USER MANAGEMENT MENU

The User Management menu allows you to add or change your PIN code, tag, and/or user name code. When you are on the User Management menu, the red LED remains on without flashing and the green LED is off.

Red	Green
	

The User Management menu contains the following menus. To access a menu, press its menu number:


Menu Number	Description
1	Change PIN code.
2	Change tag.
3	Change user name code.


When you select a menu, the red LED remains on without flashing and the green LED flashes the menu number every two seconds.

SPECIFY THE PIN CODE, TAG, AND/OR USER NAME CODE


Take the following steps to access the User Management menu and add or change your PIN code, tag, and/or user name code.

Note: If the ECS doesn't detect keypad activity for five minutes, the ECS automatically logs off.

1. Press and hold the  button for two seconds, until you hear the [Pushbutton sound](#) twice and the red LED starts flashing.


Red	Green
	

2. Perform one of the following steps:

- Place your user tag in front of the ECS.
- Enter your user ID and PIN code, then press .

Note: If your user ID is 1–9, enter 0 before the digit. For example, if the user ID is User 3, enter 03.


The buzzer sounds the Success sound, indicating that you have accessed the User Management menu.

Red	Green
	

You can now perform any or all of the tasks listed in the following headings. The tasks can be performed in any order:

Add or Change the PIN Code

- a. Press 1, then press .

Red	Green
	




- b. Enter the PIN code, which must be between 2–6 digits.

Tip: If you need to clear the digits you've entered, press . You can then enter the new PIN code.

- c. Press  to save the PIN code and return to the User Management menu.

Add or Replace the Tag

- a. Press 2, then press .





Red	Green
	 

- b. Place the tag in front of the ECS until you hear the Success sound. The ECS returns to the User Management menu.

Note: Replacing a tag invalidates any tags previously created for the user ID.


Add or Change the User Name Code

- a. Press 3, then press .


Red	Green
	  

- b. Enter the user name code, which can be any number between 0–9999.

Note: The user name code is not your user ID, is not required, and is **not** used to log on to the ECS. The user name code can be used for information such as an alias or an employee ID.

- c. Press  to save the user name code and return to the User Management menu.

3. Press  to log off.

Red	Green
	

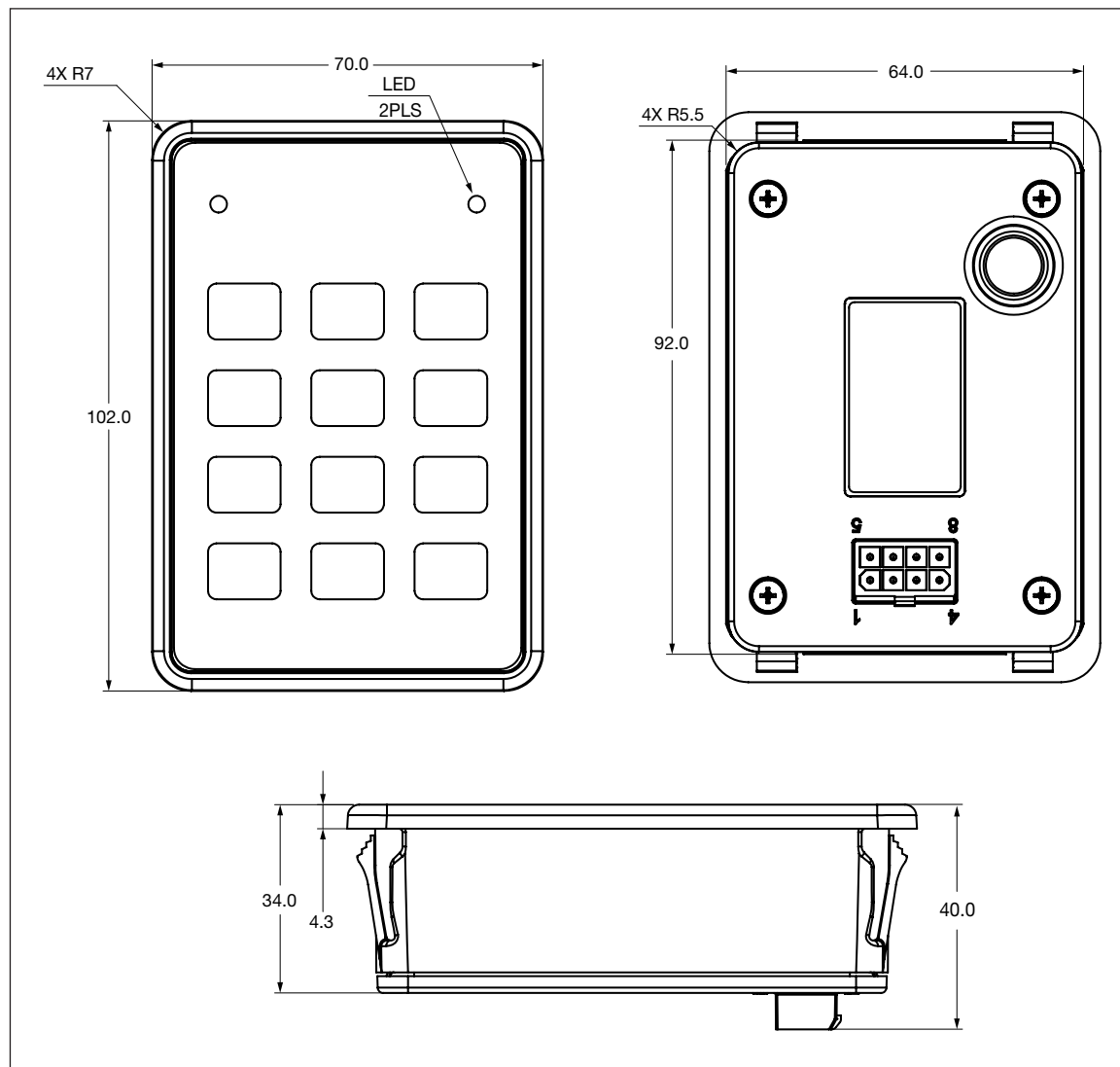
4 – INSTALLATION AND WIRING

This chapter explains how to install and wire the ECS and how to configure the inputs and outputs (I/Os).

INSTALLING THE ECS

To install the ECS, snap-fit it into the desired location, using 2.0–4.0 mm snap-in fingers. The location should be carefully chosen to keep the ECS clean and dry. Figure 1 shows the mounting dimensions:

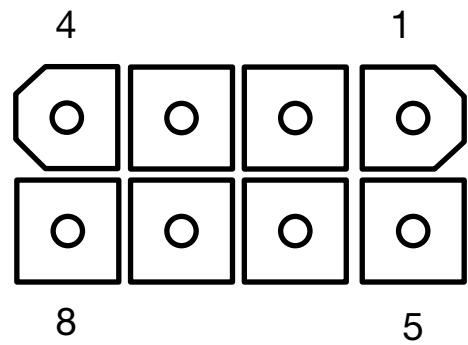
Figure 1
*Mounting
Dimensions*



Note: The panel hole size is 92.3×64.3 mm, with a tolerance of $+0.7$ mm for both the length and width.

I/O CONNECTOR

The ECS provides an 8-pin connector for the I/Os.



The mating connector is an 8-pin Mini-Universal MATE-N-LOK housing plug from TE Connectivity. The front of the ECS is sealed to IP65. The rear of the ECS is sealed to IP65 for electronic components and to IP40 for the connector. You can increase the connector’s protection to IP54 by using the parts listed in Table 2.

The following tables list the TE Connectivity parts for IP40 and IP54 protection.

Table 1 Mating Connector Parts — IP40 Protection

Part	TE Connectivity Part Number
Connector Housing	770579-1
Terminal (18–22 AWG)	770904- <i>X</i>

Table 2 Mating Connector Parts — IP54 Protection

Part	TE Connectivity Part Number
Connector Housing	794821-1
Terminal (18–22 AWG)	770904- <i>X</i>
Interface Seal	794772-8
Single Wire Seal or Gang Seal	<ul style="list-style-type: none">• Single: 794758-1• Gang: 1586359-8
Cavity Plug Seal (for unused terminal positions)	794995-1

I/O PINS

The following table describes the I/O pins.

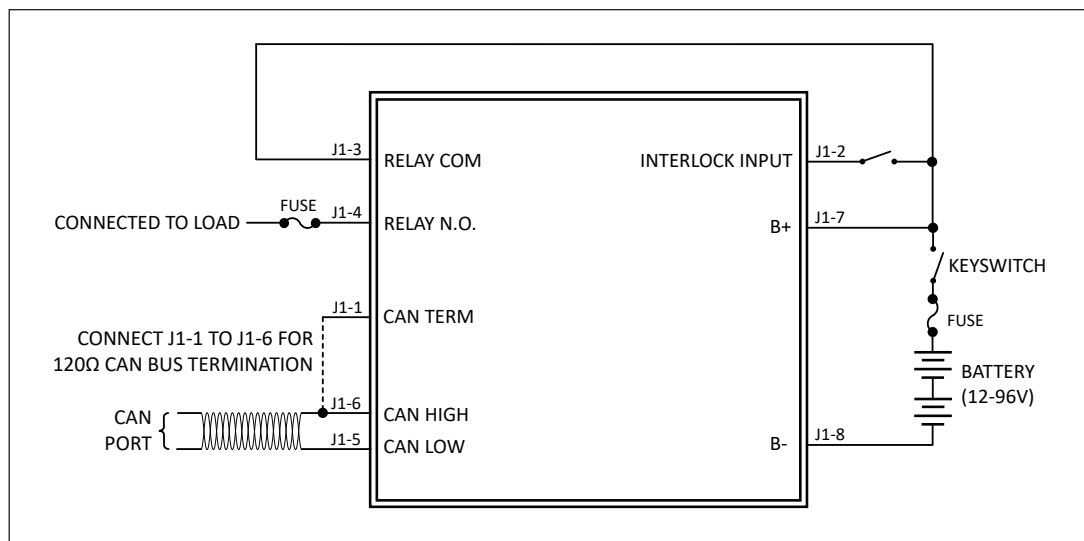
Table 3 ECS Pins

Pin	Signal Name	Description
J1-1	CAN Term	CAN terminating 120Ω resistor. Note: To enable the resistor, connect this pin to pin J1-6.
J1-2	Interlock Input	Active high; 12–96V
J1-3	Relay COM	Power to relay; 12– 96V
J1-4	Relay NO	Relay output
J1-5	CAN Low	
J1-6	CAN High	
J1-7	B+	Battery Positive
J1-8	B–	Battery Common

WIRING DIAGRAM

The following diagram illustrates a configuration in which the ECS is connected to an interlock switch.

Figure 2
Wiring Diagram



Note: Use fuses that are appropriately sized for your application.

BATTERY CONNECTIONS

Connect the battery to the B+ and B– pins (pins 7–8, respectively). The following table describes the B+ pin's operating voltage:

Minimum	Nominal	Maximum
9VDC	12–96VDC	120VDC

Note: All voltages listed in this manual are DC voltages.

The following table describes the B+ pin's operating current:

B+ Voltage	Operating Current
12V	248mA
24V	114mA
36V	70mA
48V	52mA
60V	44mA
72V	37mA
80V	32mA
96V	33mA

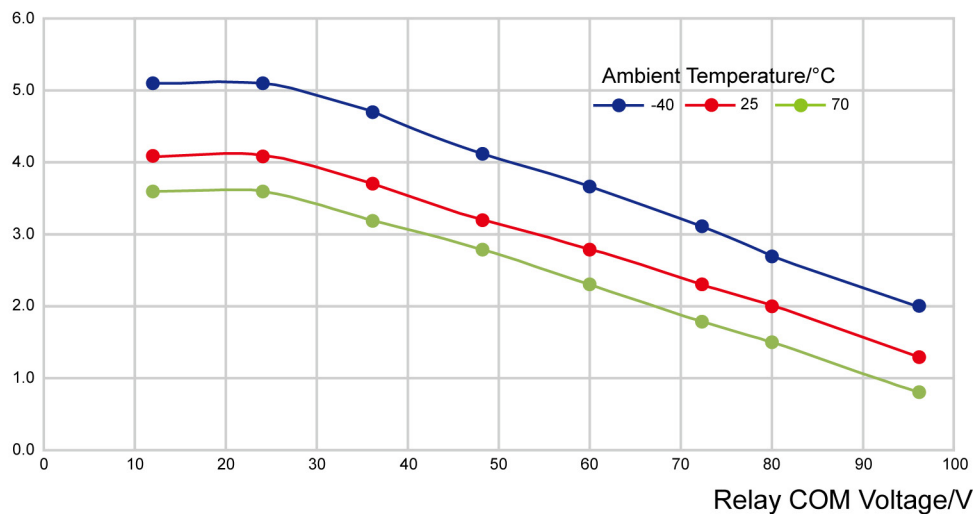
PRECHARGE

To suppress arcing across the relay contacts when the relay closes, the ECS uses a current-limited precharge circuit to power the devices connected to Relay NO. The relay closes when the Relay NO voltage reaches 90% of the Relay COM voltage; if the relay doesn't close, a Precharge Fault occurs.

The following table and chart show the precharge current limits for Relay COM voltages at various ambient temperatures:

Battery Voltage	Ambient Temperature		
	-40°C	25°C	70°C
12V	5.1A	4.1A	3.6A
24V	5.1A	4.1A	3.6A
36V	4.7A	3.7A	3.2A
48V	4.1A	3.2A	2.8A
60V	3.7A	2.8A	2.3A
72V	3.2A	2.3A	1.8A
80V	2.7A	2.0A	1.5A
96V	2.0A	1.3A	0.8A

Precharge Current/A



RELAY OUTPUT

The ECS uses a normally open (NO) relay as an output driver. When the relay engages, Relay NO (pin 4) outputs the power provided by the power source. Connect Relay COM (pin 3) in series with the power source, and connect Relay NO to the load.

The following table describes the Relay COM operating voltage:

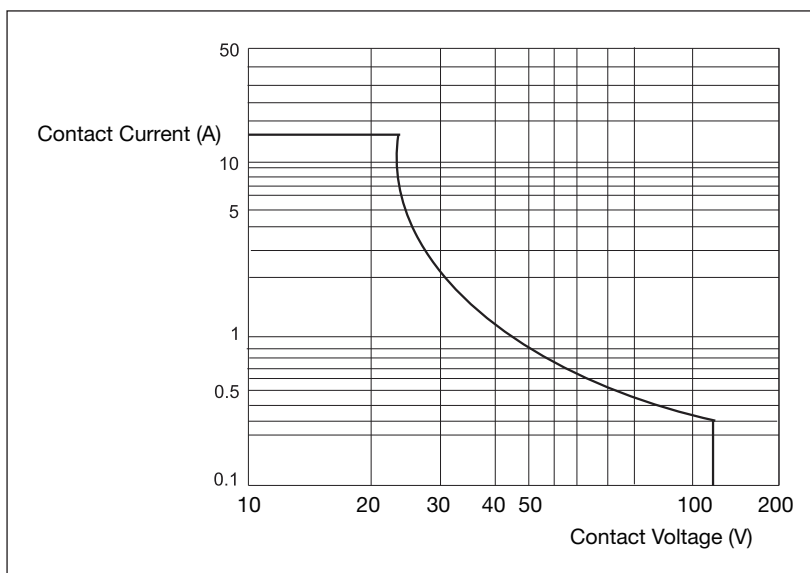
Nominal	Minimum	Maximum
12–96V	9V	120V

The following table and Figure 3 describe the maximum switching current for various voltages when a resistive load is connected:

Contact Voltage	Maximum Switching Current
12V	16.0A
24V	16.0A
36V	1.5A
48V	0.9A
60V	0.7A
72V	0.6A
80V	0.5A
96V	0.3A
120V	0.3A

Figure 3

Relay Contacts — Maximum Switching Current



When the ECS commands the relay to close or open, the [Relay State](#) parameter indicates the relay's state:

- When the relay closes, the Relay State value changes in this order: 0, 1, 2, 3, 4, 5.
- When the relay opens, the Relay State value changes in this order: 5, 6, 8, 0.

The Relay Work Mode parameter specifies whether logging on or CAN commands engage the relay. There also are parameters for configuring the relay's pull-in and holding voltages; see [Relay Menu](#).

INTERLOCK

When the interlock state is off and the logoff interval has expired, the ECS automatically logs the user off. The logoff interval is specified with the Logoff Time parameter.

Note: The automatic logoff can be disabled by setting Logoff Time to 0.

The interlock signal can be controlled with either a switch, such as a seat switch, or RPDO1. The Interlock Type parameter specifies the interlock signal's source.

If the vehicle uses an interlock switch, connect the switch to pin 2. When a switch is used, the interlock's input voltage ranges from 0V to the B+ voltage. The interlock input is active high; the interlock state is off when the interlock input's voltage is below the voltage specified with the Interlock High Threshold parameter.

Note: For information on the interlock parameters, see [Control Menu](#).

CANbus

To connect the ECS to the CANbus, connect CAN Low and CAN High to pins 5 and 6, respectively. Use twisted-pair wiring to minimize the likelihood of picking up a voltage bias on only one signal.

Pin 1 provides access to an internal 120Ω terminating resistor. To enable the resistor, connect CAN High (pin 6) to pin 1.

The ECS includes parameters for items such as the baud rate, heartbeat rate, node ID, and PDOs. For more information, see [CAN Interface Menu](#) and [CANopen Communications](#).

CALIBRATE THE ANTENNA

After the ECS is installed, calibrate the antenna so that the ECS automatically detects the best channel for RFID recognition. You can calibrate with either of the following:

- The [AM Base Calibration](#) parameter.
- The keypad; see the [Calibrate the Antenna](#) section.

5 — THE ECS SUPERVISOR AND USERS

The *ECS supervisor* is responsible for authorizing *users* to log on to the ECS. The supervisor authorizes users by creating PIN codes and/or tags for user IDs. After the supervisor creates a user, the user can log onto the ECS by swiping the tag or entering the user ID and PIN code.

The supervisor can delete users. When a user is deleted, the user's PIN code and/or RFID tag are deactivated and the user can no longer log on to the ECS.

The ECS provides 100 user IDs. The supervisor's user ID is 00. The remaining user IDs, which range from 01 through 99, are for users.

CAUTION

The default supervisor PIN code is 123456. For security reasons, change the supervisor's PIN code as soon as possible.

The following considerations apply to supervising users:

- The default PIN code for users is 1234. After the supervisor creates a PIN code for a user ID, the user should specify a different PIN code.
- After the supervisor creates a tag for a user ID, the user can create a PIN code.
- After the supervisor creates a PIN code for a user ID, the user can create a tag.
- The supervisor can remove a user's tag while preserving the user's PIN code, and vice versa.
- The supervisor logs on with the ECS keypad.
- The supervisor manages users with the keypad or with a Curtis programming device, as described in the following topics:
 - [Supervisor Operation with the Keypad](#)
 - [Manage Users with Curtis Programming Devices](#)

Note: The supervisor can also use the keypad to update some parameters and calibrate the antenna field strength level.

USER STATUSES

Each user ID has a user status. The user status indicates whether and how the user can access the ECS. User statuses are identified by numbers and are described in the following table:

Table 4 User Statuses

User Status	Description
1	The user is not authorized to access the ECS.
2	The user only has a PIN code.
3	The user only has a tag.
4	The user has both a PIN code and a user tag.

6 — PROGRAMMABLE PARAMETERS

LOGON USER MANAGEMENT MENU..... [p. 18](#)

- Logon User ID
- Logon User Name Code
- Logon RFID 1
- Logon RFID 2
- Logon RFID 3

LOGON USER SETUP MENU..... [p. 19](#)

- New PIN Code
- Save New PIN Code
- New RFID Tag
- Delete RFID Tag
- New Name Code
- Save New Name Code

SUPERVISOR MANAGEMENT MENU..... [p. 20](#)

- First Free User ID
- Target User ID
- Target User State
- Create Target User PIN Code
- Create Target User RFID Tag
- Delete Target User

USER INFORMATION MENU..... [p. 21](#)

- Last Logon User ID
- Total Registered Users

REGISTERED USER LIST MENU.... [p. 21](#)

SUPERVISOR MENU..... [p. 21](#)

- User Status
- User Name Code

USER 01—USER 99 MENUS... [p. 21](#)

- User Status
- User Name Code

APPLICATION SETUP MENU..... [p. 22](#)

CONTROL MENU..... [p. 22](#)

- Interlock Type
- Interlock High Threshold
- Mute Enable
- Logoff Time
- RFID Swipes Logoff Enable

RELAY MENU..... [p. 23](#)

- Relay Work Mode
- Pull-in Voltage
- Holding Voltage
- Open Delay
- Relay Driver
- Relay Driver PWM
- Relay Driver Feedback

CAN INTERFACE MENU..... [p. 24](#)

- Baud Rate
- Node ID
- Heartbeat Rate
- Auto Operation
- CAN NMT State

RPD01—RPD04 SETUPS MENUS.... [p. 25](#)

- RPD0*n* Event Time
- RPD0*n* COB ID
- RPD01—RPD04 SETUPS MENUS..... [p. 25](#)
 - Length
 - Map 1 through Map 8

TPD01—TPD04 SETUPS MENUS.... [p. 25](#)

- TPD0*n* Event Time
- TPD0*n* COB ID
- TPD01—TPD04 MAPPING MENUS..... [p. 25](#)
 - Length
 - Map 1 through Map 8

MISC MENU..... [p. 28](#)

- Restore Parameters
- AM Base Calibration
- Pass Through Switch

PASS THROUGH MODE MENU..... [p. 29](#)

- Input PushButton Value
- Clear PushButton Value
- RFID 0
- RFID 1
- RFID 2
- Clear RFID Input Value
- Receive RFID Input Only
- Tone Control Enable via CAN
- LED Control Enable via CAN

The programmable parameters allow you to configure the ECS so that it meets your application's requirements. [Curtis programming devices](#) provide a user-friendly way to read and write to the parameters.

Note: You can change some parameters with the keypad; see [Program Parameters with the Keypad](#).

Restart the ECS after you change a parameter marked as [PCF]. If the ECS is not restarted, a Parameter Change fault will occur.

The parameters are grouped into menus and are described in the following topics. The following columns in the parameter description tables contain multiple types of information:

- **Parameter and CAN Index:** The parameter name, followed by the CAN index and sub-index. This column also identifies parameters marked as [PCF].
Note: CAN indexes and sub-indexes are delimited by colons. For example, a parameter with an index of 0x4E46 and a sub-index of 0x00 would be represented as 0x4E46 : 00.
- **Values and Raw Values:** The allowed values as displayed in Curtis programming devices, followed by allowed values in raw units suitable for CAN messages.
- **Data Size and Read/Write.** The parameter's data size, followed by whether the parameter is writable (RW) or read-only (RO).
- **Access Level and Default Value.** The parameter's access level for Curtis programming devices, followed by the default value.

Note: Curtis programming device licenses provide different access levels to parameters.

LOGON USER MANAGEMENT MENU

The Logon User Management parameters indicate information about the logged-on user. The Logon User Management menu also contains the Logon User Setup menu.

Note: The Logon RFID 1, Logon RFID 2, and Logon RFID 3 parameters cannot be accessed through the CANbus.

LOGON USER MANAGEMENT MENU

PARAMETER CAN INDEX	VALUES RAW VALUES	DATA SIZE READ/WRITE	ACCESS LEVEL	DESCRIPTION
Logon User ID 0x3804:00	-1 to +99 -1 to +99	8-bit R0	Field Basic	Indicates the user ID of the logged-on user. Note: -1 indicates that no one is logged on. The supervisor user ID is 0.
Logon User Name Code 0x3805:00	0-99999 0-99999	32-bit R0	Field Basic	Indicates the user name code of the logged-on user.
Logon RFID 1	0-4294967295 0-4294967295	32-bit R0	Field Basic	Indicates the first four bytes of the UID of the logged-on user's RFID tag.
Logon RFID 2	0-4294967295 0-4294967295	32-bit R0	Field Basic	Indicates the second set of bytes of the RFID tag's UID. The value depends upon the tag's cascade level: <ul style="list-style-type: none"> • Cascade level 2: Three bytes • Cascade level 3: Four bytes
Logon RFID 3	0-4294967295 0-4294967295	32-bit R0	Field Basic	For cascade level 3 tags, indicates the last two bytes of the RFID tag's UID.

LOGON USER SETUP MENU

The following table describes the Logon User Setup menu. The parameters let the logged-on user create or change the user's PIN code, RFID tag, and user name code.

The Logon User Setup Menu is visible only when the supervisor is logged on to manage users or the vehicle operator is logged on to manage the user's credentials. In addition, the menu's parameters can be accessed through the CANbus only if the supervisor or vehicle operator is logged on.

LOGON USER SETUP MENU

PARAMETER CAN INDEX	VALUES RAW VALUES	DATA SIZE READ/WRITE	ACCESS LEVEL	DESCRIPTION
New PIN Code 0x3828:00	0-999999999 0-999999999	32-bit RW	Field Basic	Indicates a new PIN code for the logged-on user. Specify 9 as a control word, followed by the PIN code. For example, if the PIN code is 3579, specify 93579. The new PIN code is activated by setting the Save New PIN Code parameter to On.
Save New PIN Code 0x3829:00	Off/On 0-1	8-bit RW	Field Basic	Activates the New PIN Code.
New RFID Tag 0x3827:00	Off/On 0-1	8-bit RW	Field Basic	Adds or changes an RFID tag for the logged-on user. To add the tag, set the parameter to On, then place the tag in front of the ECS until the buzzer sounds the Success sound.
Delete RFID Tag 0x382C:00	Off/On 0-1	8-bit RW	Field Basic	Deletes the RFID tag of the logged-on user. To delete, set the parameter to On.
New Name Code 0x382A:00	0-99999 0-99999	32-bit RW	Field Basic	Indicates a new user name code. Specify 9 as a control word, followed by the user name code. For example, if the user name code is 2468, specify 92468. The new user name code is activated by setting the Save New Name Code parameter to On.
Save New Name Code 0x382B:00	Off/On 0-1	32-bit RW	Field Basic	Activates the New Name Code.

SUPERVISOR MANAGEMENT MENU

The Supervisor Management menu allows the supervisor to add and delete authorized users. This menu is visible when the supervisor has logged on to manage users.

Note: The First Free User ID parameter cannot be accessed through the CANbus. Data for the other parameters can be downloaded and uploaded only when the supervisor is logged on to manage users.

Adding a user involves creating an RFID tag and/or a PIN code for a user ID. When a PIN code or an RFID tag is added or a user is deleted, the buzzer sounds the Success sound. For steps on using this menu, see [Use the Supervisor Management Menu](#).

The following table describes the Supervisor Management parameters.

SUPERVISOR MANAGEMENT MENU

PARAMETER CAN INDEX	VALUES RAW VALUES	DATA SIZE READ/WRITE	ACCESS LEVEL	DESCRIPTION
First Free User ID	0–99 0–99	8-bit RO	Field Basic	Indicates the first user ID for which neither a PIN Code nor a user tag has been added.
Target User ID 0x3830:00	1–99 1–99	8-bit RW	Field Basic	Specifies the user ID to be managed.
Target User State 0x3831:00	1–5 1–5	8-bit RO	Field Basic	Indicates the user status of the Target User ID. 1 = The user is not authorized to access the ECS. 2 = The user only has a PIN Code. 3 = The user only has an RFID tag. 4 = The user has both a PIN Code and an RFID tag. 5 = An error has occurred.
Create Target User PIN Code 0x3833:00	Off/On 0–1	8-bit RW	Field Basic	Activates the PIN code for the Target User ID. To activate, set the parameter to On. The default PIN code is 1234. It's recommended that the user change the PIN code. If the supervisor attempts to create a new PIN code for a Target User ID that already has a PIN code, the buzzer will sound the Error sound. To create a new PIN code, delete the user, then create a PIN code for the same user ID.
Create Target User RFID Tag 0x3832:00	Off/On 0–1	8-bit RW	Field Basic	Activates the RFID tag for the Target User ID. To activate, set the parameter to On, then place the tag in front of the ECS until the buzzer sounds the Success sound. If the supervisor attempts to create a new tag for a Target User ID that already has a tag, the buzzer will sound the Error sound. To create a new tag, delete the user, then create a tag for the same user ID.
Delete Target User 0x3834:00	Off/On 0–1	8-bit RW	Field Basic	Deletes the Target User ID. To delete, set the parameter to On.

USER INFORMATION MENU

The following table describes the User Information parameters. The menu also contains the Registered User List menu.

Note: The User Information parameters cannot be accessed through the CANbus.

USER INFORMATION MENU

PARAMETER CAN INDEX	VALUES RAW VALUES	DATA SIZE READ/WRITE	ACCESS LEVEL	DESCRIPTION
Last Logon User ID	0–99 0–99	8-bit RO	Field Basic	Indicates the user ID of the last user to log onto the ECS.
Total Registered Users	0–100 0–100	8-bit RO	OEM Dealer	Indicates the number of registered users.

Registered User List Menu

The Registered User List menu contains the Supervisor menu and the User 01–99 menus, which are described in the following topics.

Supervisor Menu

The following table describes the parameters on the Supervisor menu. The supervisor's user ID is 00.

Note: The Supervisor menu parameters cannot be accessed through the CANbus.

USER INFORMATION MENU — SUPERVISOR MENU

PARAMETER CAN INDEX	VALUES RAW VALUES	DATA SIZE READ/WRITE	ACCESS LEVEL	DESCRIPTION
User Status	1–5 1–5	8-bit RO	Field Basic	Indicates the supervisor's user status. The user statuses are represented by the same values as the Target User State parameter's allowed values.
User Name Code	0–99999 0–99999	32-bit RO	Field Basic	Indicates the supervisor's user name code.

User 01–99 Menus

Each user ID has a User *n* menu, where *n* represents the user ID. The User *n* menus contain parameters with the same names, allowed values, data sizes, descriptions, etc. The following table describes the User *n* menu parameters.

Note: The User *n* menu parameters cannot be accessed through the CANbus.

USER INFORMATION MENU — USER 01–99 MENUS

PARAMETER CAN INDEX	VALUES RAW VALUES	DATA SIZE READ/WRITE	ACCESS LEVEL	DESCRIPTION
User Status	1–5 1–5	8-bit RO	Field Basic	Indicates the user's status. The user statuses are represented by the same values as the Target User State parameter's allowed values.
User Name Code	0–99999 0–99999	32-bit RO	Field Basic	Indicates the user name code.

APPLICATION SETUP MENU

The Application Setup menu contains the following menus:

- Control menu
- Relay menu
- CAN Interface menu
- Misc menu

These menus are used to configure the ECS, and are described in the following topics.

Control Menu

The following table describes the parameters on the Control menu.

APPLICATION SETUP MENU — CONTROL MENU

PARAMETER CAN INDEX	VALUES RAW VALUES	DATA SIZE READ/WRITE	ACCESS LEVEL DEFAULT VALUE	DESCRIPTION
Interlock Type 0x3705:00	0–1 0–1	8-bit RW	OEM Dealer 0	Indicates whether the interlock signal is controlled by the interlock input or RPD01: 0 = Interlock input (pin 2) 1 = RPD01
Interlock High Threshold 0x3323:00	2.00–30.00V 200–3000	16-bit RW	OEM Dealer 8.00V	Indicates the high level threshold for the interlock input.
Mute Enable 0x3701:00	Off/On 0–1	8-bit RW	Field Basic Off	Indicates whether the buzzer is muted: Off = Audible On = Muted
Logoff Time 0x3702:00	0–255 0–255 min	8-bit RW	Field Basic 30 min	Indicates the automatic logoff time. If the interlock signal has been off for the specified time, the ECS automatically logs the user off. To disable the automatic logoff, specify 0.
RFID Swipes Logoff Enable 0x5906:01	Off/On 0–1	8-bit RW	OEM Dealer Off	When set to On, specifies how the ECS operates if a user swipes the same RFID tag that was last swiped. The result depends upon the ECS's operating mode: <ul style="list-style-type: none"> • Default mode: If the user is logged on, the ECS logs the user off. • Pass-through mode: The ECS clears the RFID 0/1/2 parameters on the Pass Through Mode menu.

Relay Menu

The following table describes the parameters on the Relay menu.

APPLICATION SETUP MENU — RELAY MENU

PARAMETER CAN INDEX	VALUES RAW VALUES	DATA SIZE READ/WRITE	ACCESS LEVEL DEFAULT VALUE	DESCRIPTION
Relay Work Mode [PCF] 0x3706:00	0–2 0–2	8-bit RW	OEM Dealer 1	Indicates how the relay is engaged and disengaged: 0 = Disable relay output. The relay remains open even if an authorized user logs in. 1 = Engage and disengage the relay when an authorized user logs on or off. 2 = Engage and disengage the relay with the Control CAN State object. For more information, see RPD01 .
Pull-in Voltage 0x34C8:00	60.0–100.0% 2457–4095	16-bit RW	OEM Dealer 100.0%	Indicates the initial voltage when the relay driver is first turned on. The ECS allows a high initial voltage to ensure the relay closes. After 1 second, the voltage decreases to the Holding Voltage.
Holding Voltage 0x34C6:00	60.0–100.0% 2457–4095	16-bit RW	OEM Dealer 75.0%	Indicates the reduced voltage that the ECS applies to the relay after it has closed. Specify a voltage that is high enough to ensure the relay remains closed under all shock and vibration conditions the vehicle is expected to encounter.
Open Delay 0x34CA:00	0–4000ms 0–1000	16-bit RW	OEM Dealer 40ms	Indicates how long the relay remains closed after a user logs off or a CAN command opens the relay.
Relay Driver 0x34CC:00	Off/On 0–1	8-bit RO	Field Basic N/A	Indicates whether the relay driver is on.
Relay Driver PWM 0x34CD:00	0–100.0% 0–16384	16-bit RO	OEM Dealer N/A	Indicates the relay coil's PWM duty cycle.
Relay Driver Feedback 0x34CE:00	Off/On 0–1	8-bit RO	OEM Dealer N/A	Indicates whether the relay coil is energized: Off = Not energized On = Energized

CAN Interface Menu

The following table describes the parameters on the CAN Interface menu.

APPLICATION SETUP MENU – CAN INTERFACE MENU

PARAMETER CAN INDEX	VALUES RAW VALUES	DATA SIZE READ/WRITE	ACCESS LEVEL DEFAULT VALUE	DESCRIPTION
Baud Rate [PCF] 0x2001:01	-1 to +4 -1 to +4	8-bit RW	OEM Dealer 0	Specifies the CAN baud rate: -1 = 100 Kbps 0 = 125 Kbps 1 = 250 Kbps 2 = 500 Kbps 3 = 800 Kbps 4 = 1 Mbps
Node ID [PCF] 0x2000:01	1-7Fh 1-7Fh	8-bit RW	OEM Dealer 46h	Specifies the ECS's node ID. Note: Node ID 127 is reserved for Curtis programming devices.
Heartbeat Rate 0x1017:00	16-200ms 4-50	16-bit RW	OEM Factory 100ms	Specifies the cyclic rate of the ECS's heartbeat messages.
Auto Operation 0x32BC:00	Off/On 0-1	8-bit RW	OEM Dealer Off	Specifies the ECS's NMT state after it has powered up: On = Operational Off = Pre-operational
CAN NMT State 0x32A4:00	0-127 0-127	8-bit RO	Field Basic N/A	Indicates the ECS's NMT state: 0 = Initialization 4 = Stopped 5 = Operational 127 = Pre-operational

The CAN Interface menu contains the RPDO Setups and TPDO Setups menus. The PDO Setups menus contain the RPDO Mapping and TPDO Mapping menus, which specify the objects for which the PDOs transmit and receive data.

PDO Setups Menus and PDO Mapping Menus

The ECS provides four RPDOs and four TPDOs. The PDO Setups menus contain the PDOs' Event Time and COB-ID parameters.

Note: PDO1 and PDO2 are preconfigured to communicate with devices on the CANbus; see [PDO1](#) and [PDO2](#). PDO3 and PDO4 are not preconfigured.

The parameters on the PDO Setups menus contain similar names; the names' first words correspond to the parameters' PDOs. For example, the parameter for RPDO1's event time is named RPDO1 Event Time. The PDO Mapping menus each contain a Length parameter and the Map 1 through Map 8 parameters.

The parameters on these menu contain the same allowed values, descriptions, etc.; the only differences are the parameters' CAN indexes and default values. The following tables describe the menus' parameters, followed by a table that lists the parameters' CAN indexes and default values.

Table 5 PDO Setup Menus

PARAMETER	VALUES RAW VALUES	DATA SIZE READ/WRITE	ACCESS LEVEL	DESCRIPTION
RPDOn Event Time	0–65535ms 0–65535	16-bit RW	OEM Dealer	Specifies the RPDO's timeout. If the RPDO does not receive data before the timeout elapses, a PDO Timeout fault occurs. If the RPDO receives data, the fault will be cleared. To disable the timeout, specify 0.
TPDOn Event Time	0–65535ms 0–65535	16-bit RW	OEM Dealer	Specifies the cyclic rate of the TPDO's messages. To configure the TPDO to transmit only when the value of a mapped object changes, specify 1.
RPDOn COB ID and TPDOn COB ID	0–FFFFFFFh 0–FFFFFFFh	32-bit RW	OEM Factory	Specifies the PDO's COB-ID.

Table 6 PDO Mapping Menus

PARAMETER	VALUES RAW VALUES	DATA SIZE READ/WRITE	ACCESS LEVEL	DESCRIPTION
Length	0–8 0–8	8-bit RW	OEM Factory	Specifies the number of objects mapped to the PDO.
Map 1	0–FFFFFFFh 0–FFFFFFFh	32-bit RW	OEM Factory	Specifies the first mapped object.
Map 2	0–FFFFFFFh 0–FFFFFFFh	32-bit RW	OEM Factory	Specifies the second mapped object.
Map 3	0–FFFFFFFh 0–FFFFFFFh	32-bit RW	OEM Factory	Specifies the third mapped object.
Map 4	0–FFFFFFFh 0–FFFFFFFh	32-bit RW	OEM Factory	Specifies the fourth mapped object.
Map 5	0–FFFFFFFh 0–FFFFFFFh	32-bit RW	OEM Factory	Specifies the fifth mapped object.
Map 6	0–FFFFFFFh 0–FFFFFFFh	32-bit RW	OEM Factory	Specifies the sixth mapped object.
Map 7	0–FFFFFFFh 0–FFFFFFFh	32-bit RW	OEM Factory	Specifies the seventh mapped object.
Map 8	0–FFFFFFFh 0–FFFFFFFh	32-bit RW	OEM Factory	Specifies the eighth mapped object.

Note: For information on mapping objects, see [Map CAN Objects to a PDO](#).

Table 7 PDO Parameters' CAN Indexes and Default Values

MENU	PARAMETER	CAN INDEX	DEFAULT VALUE
RPD01 Setups	RPD01 Event Time	0x1400:05	200ms
RPD01 Setups	RPD01 COB ID	0x1400:01	246h
RPD01 Mapping	Length	0x1600:00	1
RPD01 Mapping	Map 1	0x1600:01	37800010h
RPD01 Mapping	Map 2	0x1600:02	0
RPD01 Mapping	Map 3	0x1600:03	0
RPD01 Mapping	Map 4	0x1600:04	0
RPD01 Mapping	Map 5	0x1600:05	0
RPD01 Mapping	Map 6	0x1600:06	0
RPD01 Mapping	Map 7	0x1600:07	0
RPD01 Mapping	Map 8	0x1600:08	0
TPD01 Setups	TPD01 Event Time	0x1800:05	40ms
TPD01 Setups	TPD01 COB ID	0x1800:01	400001C6h
TPD01 Mapping	Length	0x1A00:00	4
TPD01 Mapping	Map 1	0x1A00:01	38000008h
TPD01 Mapping	Map 2	0x1A00:02	4E020008h
TPD01 Mapping	Map 3	0x1A00:03	37070010h
TPD01 Mapping	Map 4	0x1A00:04	38040008h
TPD01 Mapping	Map 5	0x1A00:05	0
TPD01 Mapping	Map 6	0x1A00:06	0
TPD01 Mapping	Map 7	0x1A00:07	0
TPD01 Mapping	Map 8	0x1A00:08	0
RPD02 Setups	RPD02 Event Time	0x1401:05	0ms
RPD02 Setups	RPD02 COB ID	0x1401:01	346h
RPD02 Mapping	Length	0x1601:00	1
RPD02 Mapping	Map 1	0x1601:01	38100008h
RPD02 Mapping	Map 2	0x1601:02	0
RPD02 Mapping	Map 3	0x1601:03	0
RPD02 Mapping	Map 4	0x1601:04	0
RPD02 Mapping	Map 5	0x1601:05	0
RPD02 Mapping	Map 6	0x1601:06	0
RPD02 Mapping	Map 7	0x1601:07	0
RPD02 Mapping	Map 8	0x1601:08	0
TPD02 Setups	TPD02 Event Time	0x1801:05	40ms
TPD02 Setups	TPD02 COB ID	0x1801:01	400002C6h
TPD02 Mapping	Length	0x1A01:00	6
TPD02 Mapping	Map 1	0x1A01:01	38140008h
TPD02 Mapping	Map 2	0x1A01:02	38040008h
TPD02 Mapping	Map 3	0x1A01:03	38130008h
TPD02 Mapping	Map 4	0x1A01:04	38110008h
TPD02 Mapping	Map 5	0x1A01:05	38120010h
TPD02 Mapping	Map 6	0x1A01:06	38030008h
TPD02 Mapping	Map 7	0x1A01:07	0
TPD02 Mapping	Map 8	0x1A01:08	0
RPD03 Setups	RPD03 Event Time	0x1402:05	40ms

Table 7 PDO Parameters' CAN Indexes and Default Values, cont'd

MENU	PARAMETER	CAN INDEX	DEFAULT VALUE
RPD03 Setups	RPD03 COB ID	0x1402:01	0x80000446
RPD03 Mapping	Length	0x1602:00	0
RPD03 Mapping	Map 1	0x1602:01	0
RPD03 Mapping	Map 2	0x1602:02	0
RPD03 Mapping	Map 3	0x1602:03	0
RPD03 Mapping	Map 4	0x1602:04	0
RPD03 Mapping	Map 5	0x1602:05	0
RPD03 Mapping	Map 6	0x1602:06	0
RPD03 Mapping	Map 7	0x1602:07	0
RPD03 Mapping	Map 8	0x1602:08	0
TPD03 Setups	TPD03 Event Time	0x1802:05	40ms
TPD03 Setups	TPD03 COB ID	0x1802:01	0xC0003C6
TPD03 Mapping	Length	0x1A02:00	0
TPD03 Mapping	Map 1	0x1A02:01	0
TPD03 Mapping	Map 2	0x1A02:02	0
TPD03 Mapping	Map 3	0x1A02:03	0
TPD03 Mapping	Map 4	0x1A02:04	0
TPD03 Mapping	Map 5	0x1A02:05	0
TPD03 Mapping	Map 6	0x1A02:06	0
TPD03 Mapping	Map 7	0x1A02:07	0
TPD03 Mapping	Map 8	0x1A02:08	0
RPD04 Setups	RPD04 Event Time	0x1403:05	40ms
RPD04 Setups	RPD04 COB ID	0x1403:01	0x80000546
RPD04 Mapping	Length	0x1603:00	0
RPD04 Mapping	Map 1	0x1603:01	0
RPD04 Mapping	Map 2	0x1603:02	0
RPD04 Mapping	Map 3	0x1603:03	0
RPD04 Mapping	Map 4	0x1603:04	0
RPD04 Mapping	Map 5	0x1603:05	0
RPD04 Mapping	Map 6	0x1603:06	0
RPD04 Mapping	Map 7	0x1603:07	0
RPD04 Mapping	Map 8	0x1603:08	0
TPD04 Setups	TPD04 Event Time	0x1803:05	40ms
TPD04 Setups	TPD04 COB ID	0x1803:01	0xC00004C6
TPD04 Mapping	Length	0x1A03:00	0
TPD04 Mapping	Map 1	0x1A03:01	0
TPD04 Mapping	Map 2	0x1A03:02	0
TPD04 Mapping	Map 3	0x1A03:03	0
TPD04 Mapping	Map 4	0x1A03:04	0
TPD04 Mapping	Map 5	0x1A03:05	0
TPD04 Mapping	Map 6	0x1A03:06	0
TPD04 Mapping	Map 7	0x1A03:07	0
TPD04 Mapping	Map 8	0x1A03:08	0

Misc Menu



The following table describes the parameters on the Misc menu.

APPLICATION SETUP MENU – MISC MENU

PARAMETER CAN INDEX	VALUES RAW VALUES	DATA SIZE READ/WRITE	ACCESS LEVEL DEFAULT VALUE	DESCRIPTION
Restore Parameters [PCF] 0x4E46:00	Off/On 0–1	8-bit RW	OEM Dealer Off	Resets all parameters to their default values. To reset, specify On. After the parameters have been reset, the value reverts to Off.
AM Base Calibration [PCF] 0x3612:00	Off/On 0–1	8-bit RW	OEM Dealer Off	Calibrates the antenna field strength level so that the ECS automatically detects the best channel for RFID recognition. To calibrate, specify On. After calibration has finished, the value reverts to Off.
Pass Through Switch [PCF] 0x3712:00	0–1 0–1	8-bit 0	OEM Dealer 0	Indicates whether the ECS is running in pass-through mode. 0 indicates that pass-through mode is off. Note: If the value is 1, the Pass Through Mode menu is visible.

PASS THROUGH MODE MENU


The Pass Through Mode menu is visible if the ECS is operating in pass-through mode. Pass-through mode allows another CAN device to receive keypad entries and RFID tag swipes and to control the buzzer and LEDs. Pass-through mode has the following characteristics:

- Users cannot log on.
- The ECS remains in the idle state.
- The Input PushButton Value parameter stores the keys that were entered before the  button was pressed. The parameter is reset to 0 if the Clear PushButton Value parameter is set to On or an RFID tag is swiped.
- The RFID 0/1/2 parameters store the UIDs of swiped tags. There are two ways to reset these parameters to 0:
 - If the Receive RFID Input Only parameter is set to Off, the user can press one or more numeric keys, then press the  button.
 - If the RFID Swipes Logoff Enable parameter is set to On, the user can swipe the same RFID tag again.



To enable pass-through mode, set the Pass Through Switch parameter to 1.

The following table describes the Pass Through Mode parameters.

PASS THROUGH MODE MENU

PARAMETER CAN INDEX	VALUES RAW VALUES	DATA SIZE READ/WRITE	ACCESS LEVEL DEFAULT VALUE	DESCRIPTION
Input PushButton Value 0x5902:00	0–999999999 0–999999999	32-bit RO	OEM Dealer N/A	Indicates the keys that were pressed before the  button was pressed. 9 is prepended to the key numbers. For example, if the 3579 keys were pressed, the value would be 93579. Note: If more than eight keys have been pressed, the buzzer sounds the Error sound to indicate that the maximum value was exceeded.
Clear PushButton Value 0x5902:01	Off/On 0–1	8-bit RW	OEM Dealer 0	Sets the Input PushButton Value parameter to 0 when On is specified.
RFID 0 0x5901:00	0–4294967295 0–4294967295	32-bit RO	OEM Dealer N/A	Indicates the first four bytes of the RFID tag's UID.
RFID 1 0x5901:01	0–4294967295 0–4294967295	32-bit RO	OEM Dealer N/A	Indicates the second set of bytes of the RFID tag's UID. The value depends upon the tag's cascade level: <ul style="list-style-type: none"> • Cascade level 2: Three bytes • Cascade level 3: Four bytes
RFID 2 0x5901:02	0–4294967295 0–4294967295	32-bit RO	OEM Dealer N/A	For cascade level 3 tags, indicates the last two bytes of the tag's UID.
Clear RFID Input Value 0x5902:02	Off/On 0–1	8-bit RW	OEM Dealer Off	When set to On, clears the RFID 0, RFID 1, and RFID 2 parameters.

PASS THROUGH MODE MENU, cont'd

PARAMETER CAN INDEX	VALUES RAW VALUES	DATA SIZE READ/WRITE	ACCESS LEVEL DEFAULT VALUE	DESCRIPTION
Receive RFID Input Only 0x5906:00	Off/On 0–1	8-bit RW	OEM Dealer Off	Indicates whether the ECS accepts input only from RFID tags: <ul style="list-style-type: none"> On: Keypad entries are ignored: the Input PushButton Value parameter is not updated when  is pressed, and the buzzer does not sound and the red LED does not flash when a key is pressed. Off: Keypad entries are accepted. In addition, the user can take the following steps to clear the RFID 0, RFID 1, and RFID 2 parameters: <ol style="list-style-type: none"> Press one or more numeric keys. Press .
Tone Control Enable via CAN 0x5904:00	Off/On 0–1	8-bit RW	OEM Dealer Off	When set to On, the buzzer is controlled by the ToneControlByte CAN object.
LED Control Enable via CAN 0x5905:00	Off/On 0–1	8-bit RW	OEM Dealer Off	When set to On, the LEDs are controlled by the RedLEDControlByte and GreenLEDControlByte CAN objects.

7 – SYSTEM MONITOR MENU


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The System Monitor menu contains read-only parameters that display real-time data. You can use these parameters to configure and troubleshoot the ECS. The System Monitor menu includes menus that contain parameters, as well as the ECS State parameter.

The System Monitor menu also contains the Fault History menu, which lists the fault history and provides a parameter to clear the history.

The following table describes the ECS State parameter.

SYSTEM MONITOR MENU

PARAMETER CAN INDEX	VALUES RAW VALUES	DATA SIZE	ACCESS LEVEL	DESCRIPTION
ECS State 0x3801:00	0–4 0–4	8-bit	Field Basic	Indicates the ECS's operational state: 0 = Idle 1 = PIN code or RFID tag validation. For example, the ECS is in this state when a user presses and holds  for two seconds before entering a user ID and PIN code or swiping an RFID tag. 2 = Supervisor management. The supervisor is logged on to manage users. 3 = User management. A user is logged on to manage the PIN code and/or user name. 4 = Logged on. A user is logged on to drive the vehicle.

The following topics describe the System Monitor menus.

STATE MENU

The following table describes the parameters on the State menu.

STATE MENU

PARAMETER CAN INDEX	VALUES RAW VALUES	DATA SIZE	ACCESS LEVEL	DESCRIPTION
Interlock State 0x3322:00	Off/On 0–1	8-bit	Field Basic	Indicates whether the interlock signal is active: Off = Inactive On = Active
Relay State 0x34C9:00	0–9 0–9	8-bit	Field Basic	Indicates the relay operation state: 0 = Open 1 = Precharge 2 = Relay Welded fault check 3 = Closing delay. The relay has closed but its status is being confirmed. 4 = Missing check. The ECS is verifying whether the relay has closed. 5 = Relay is closed 6 = Open delay. The relay has received the open command but remains closed until the Open Delay expires. 7 = <i>Reserved</i> 8 = Delay. The relay is open but is within a 96ms delay before the relay can be closed again. 9 = Fault Note: If the battery voltage is less than 8V, the relay immediately enters the Delay state, regardless of the timeout specified with the Open Delay parameter. After 96ms the relay state changes to Open. If the battery voltage increases to 9.5V while the relay state is Open, the ECS will turn on the relay driver again.
Buzzer State 0x4E20:00	Off/On 0–1	8-bit	Field Basic	Indicates whether the buzzer is sounding a notification: Off = Buzzer is silent On = Buzzer is sounding

INPUTS MENU

The Inputs menu contains the Switch Status and Voltage menus, which are described in the following topics.

Switch Status Menu

The Switch Status menu contains the Interlock Switch parameter:

INPUTS MENU — SWITCH STATUS MENU

PARAMETER CAN INDEX	VALUES RAW VALUES	DATA SIZE	ACCESS LEVEL	DESCRIPTION
Interlock Switch 0x3320:00	Off/On 0-1	8-bit	Field Basic	Indicates whether the interlock input is on.

Voltage Menu

The following table describes the parameters on the Voltage menu.

INPUTS MENU — VOLTAGE MENU

PARAMETER CAN INDEX	VALUES RAW VALUES	DATA SIZE	ACCESS LEVEL	DESCRIPTION
Battery Voltage 0x3393:00	0-150.00V 0-15000	16-bit	Field Basic	Indicates the B+ input's voltage.
Relay COM Voltage 0x34C5:00	0-150.00V 0-15000	16-bit	Field Basic	Indicates the Relay COM input's voltage.
Interlock Voltage 0x34AF:00	0-35.00V 0-3500	16-bit	OEM Dealer	Indicates the interlock input's voltage. Note: If the input's voltage exceeds 35V, the parameter value will be clamped to 35V.

FAULT HISTORY MENU

The Fault History menu lists the history of the ECS’s faults. Each fault’s history includes the Count, Time, First Time, and Type parameters, as shown in the following screenshots from the Curtis Integrated Toolkit™ (CIT) and the Curtis 1313 handheld programmer:

Figure 4
Fault History Details — CIT

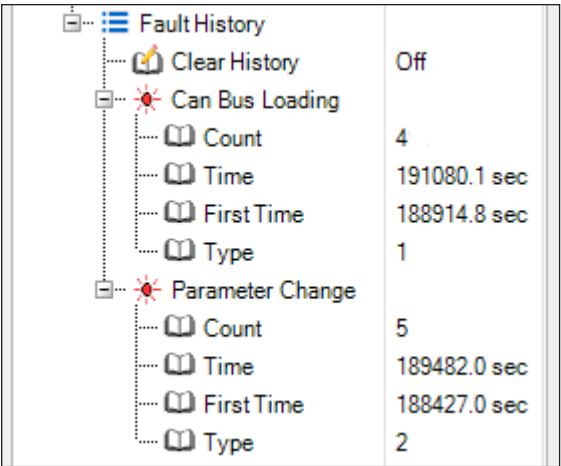
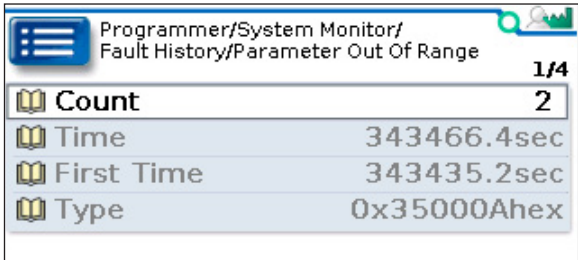


Figure 5
Fault History Details — 1313 Programmer



The menu also provides the Clear History parameter:

FAULT HISTORY MENU

PARAMETER CAN INDEX	VALUES RAW VALUES	DATA SIZE READ/WRITE	ACCESS LEVEL DEFAULT VALUE	DESCRIPTION
Clear History 0x20F0:01	Off/On 0-1	16-bit RW	OEM Dealer Off	Clears the fault history. To clear the history, specify On. After the fault history has been cleared, the value reverts to Off.

8 – DIAGNOSTICS AND FAULTS

The ECS provides diagnostic information to help technicians troubleshoot. You can view the diagnostic information with Curtis programming devices and the status LEDs.

PROGRAMMING DEVICE DIAGNOSTICS

The following list describes how Curtis programming devices display diagnostic information:

- Real-time data such as the statuses of inputs and outputs are displayed in the [System Monitor menu](#).
- A history of faults is displayed in the [Fault History menu](#).
- Active faults are displayed above the parameter menus. The following examples from CIT and the Curtis 1313 handheld programmer show that a Parameter Change fault is active:

Figure 6
Active Faults — CIT
















Name	Device Value
  Parameter Change	
  System Monitor	
  Logon User Management	
  User Information	
  Application Setup	

Figure 7
Active Faults — 1313 Programmer

Programmer	
 Parameter Change	1/5
 System Monitor	
 Logon User Management	
 User Information	
 Application Setup	

Tip: To see a fault’s fault type in CIT, expand the fault. To see a fault’s fault type in the 1313 programmer, select the fault.

LEDs AND FAULT CODES

When one or more faults are active, the red and green LEDs indicate the faults in the following flash sequence:

1. The red LED indicates the fault code's first digit by flashing n times, where n is the digit.
2. The green LED indicates the fault code's second digit by flashing n times, where n is the digit.

For example, if the fault code is 34, the red LED flashes three times, then the green LED flashes four times.

Red	Green
	

3. A delay occurs.
4. If more than one fault is active, the previous steps occur for each fault.
5. The sequence repeats as long as there are active faults.

When a fault occurs, the ECS transmits a CANopen emergency message that includes the fault code. See [Emergency Messages and Faults](#).

FAULT RECORDS

Each ECS fault is represented by a *Fault Record*. Fault Records are identified by the CAN indexes listed in [Table 8](#). The following table describes the sub-indexes of Fault Records:

SUB-INDEX	FAULT HISTORY PARAMETER	DESCRIPTION	READ / WRITE	VALUES DATA SIZE
01h	N/A	The status of the fault: <ul style="list-style-type: none"> • 00h = The fault has never occurred. • 01h = The fault is not active. • 03h = The fault is active. 	RO	0–255 8-bit
02h	N/A	<i>Reserved.</i>	N/A	N/A
03h	Count	The number of times the fault has occurred since the fault history was cleared.	RO	0–4294967295 32-bit
04h	Time	The time, in seconds, of the fault's most recent occurrence since the fault history was cleared. To calculate the number of seconds, divide the value by 10.	RO	0–4294967295 32-bit
05h	First Time	The time, in seconds, of the fault's first occurrence since the fault history was cleared. To calculate the number of seconds, divide the value by 10.	RO	0–4294967295 32-bit
06h	Type	The fault's fault type. If multiple instances of the fault have occurred and the instances have different fault types, sub-index 06h contains the most recent instance's fault type.	RO	0–4294967295 32-bit

Note: Sub-indexes 03h through 06h correspond to the parameters contained by the faults in the Fault History menu. The Fault History Parameter column lists the parameters' names.

FAULT CODES

When the ECS detects a fault, it operates in a manner that is safe in the presence of that fault. Depending on a fault's severity, a fault's effect can range from no action to shutting down operation.

Some faults have multiple causes. The ECS uses *fault types* to distinguish these causes. All faults have a fault type of 1; faults with multiple causes have additional fault types.

The following table describes the fault codes.

Table 8 Fault Codes

FAULT CODE CAN INDEX	NAME FAULT ACTIONS	POSSIBLE CAUSES	FAULT TYPE	SET CONDITION	CLEAR CONDITION
13 0x2223	Precharge Failed <i>Disengage relay Shut down</i>	<ul style="list-style-type: none"> Incorrect Relay COM voltage Defective precharge circuit 	1	<ul style="list-style-type: none"> After 500ms of precharging, the Relay NO voltage is less than 90% of the Relay COM voltage. After 10ms of precharging, the Relay NO voltage is less than the larger of the following voltages: <ul style="list-style-type: none"> 6V 90% of the Relay COM voltage. 	Address the possible causes, then cycle the power.
			2	The Relay COM voltage is less than 4V for 40ms and the Relay Work Mode parameter value is not 0.	
21 0x2222	Relay Driver Fault <i>Disengage relay Shut down</i>	Defective relay driver	1	Relay driver feedback is low with the relay driver signal off for 100ms.	Address the possible causes, then cycle the power.
		<ul style="list-style-type: none"> Open relay coil Defective relay driver 	2	Relay driver feedback is high with the relay driver signal on for 100ms.	
22 0x2221	Relay Did Not Close <i>Disengage relay Shut down</i>	Incorrect Pull-in Voltage parameter value.	1	96ms after the relay driver was turned on, the voltage difference between Relay NO and Relay COM is greater than 4V.	Address the possible causes, then cycle the power.
		Defective relay	2	With the relay on, the voltage difference between Relay NO and Relay COM is greater than 2V for 96ms.	
23 0x2220	Relay Welded <i>Disengage relay Shut down</i>	Defective relay	1	Before the ECS turns on the relay driver, the Relay COM voltage is greater than 4V and the voltage difference between Relay NO and Relay COM is less than 0.7V for 96ms.	Address the possible causes, then cycle the power.
32 0x2591	Hardware Fault <i>Disengage relay Shut down</i>	Defective keypad button	1	A button on the keypad was pressed while the ECS was powering on.	Address the possible causes, then cycle the power.

Table 8 Fault Codes, cont'd

FAULT CODE CAN INDEX	NAME FAULT ACTIONS	POSSIBLE CAUSES	FAULT TYPE	SET CONDITION	CLEAR CONDITION
33 0x2813	Parameter Change <i>Shut down</i>	The value of a parameter was changed and the parameter requires the ECS to be restarted.	1	The value of a parameter marked as [PCF] in the Programmable Parameters chapter was changed.	Cycle the power.
			2	The AM Base Calibration parameter was set to On.	
			3	The Restore Parameters parameter was set to On.	
34 0x2811	Parameter Out Of Range <i>Shut down</i>	Incorrect parameter value	CAN index of parameter	A parameter value is outside the range of valid values.	Change the parameter to a valid value, then cycle the power.
41 0x2541	PDO Timeout <i>No action</i>	<ul style="list-style-type: none"> CANbus is too heavy The RPDO's Event Time is less than the corresponding TPDO's Event Time. 	1	RPDO1 did not receive data before the Event Time timeout expired.	The RPDO receives data or the power is cycled.
			2	RPDO2 did not receive data before the Event Time timeout expired.	
			3	RPDO3 did not receive data before the Event Time timeout expired.	
			4	RPDO4 did not receive data before the Event Time timeout expired.	
42 0x2542	PDO Mapping Error <i>Disengage relay</i> <i>Shut down</i>	The data for a mapped object in an RPDO is incorrect.	1	A mapped object has one of the following errors: <ul style="list-style-type: none"> Invalid CAN index Incorrect data length Incorrect access mode 	Fix the data, then cycle the power.
		The data for a mapped object in a TPDO is incorrect.	2		
43 0x2540	CAN bus Error <i>No action</i>	<ul style="list-style-type: none"> CANbus is too heavy CANbus is defective 	1	More than 10 messages were sent within 100ms.	The CANbus is free for 100ms.
45 0x2830	NV Failure <i>Shut down</i>	Defective non-volatile memory	Block number	Three attempts to read from or write to non-volatile memory failed.	Cycle the power

9 — CANopen COMMUNICATIONS

The ECS complies with the CAN in Automation (CiA) CANopen DS 301 specification. This chapter describes the ECS's CANopen features.

Some familiarity with CANopen is a prerequisite. For CANopen information, see the following pages on the CiA web site:

- <https://www.can-cia.org/canopen/>
- <https://www.can-cia.org/groups/specifications/>

BYTE AND BIT SEQUENCE ORDER

CANopen message byte sequences are transmitted with the least significant byte first (little-endian format).

Note: This manual uses the LSB 0 Numbering convention when referring to byte and bit numbers.

For example, the following table shows an SDO that sets the object with index and subindex 334C01h to the value 04E2h.

0	1	2	3	4	5	6	7
Control Byte	Index		Sub-index	Data			
2Bh	4Ch	33h	01h	E2h	04h	00h	00h

Strings are read from left to right, with the least significant bit transmitted first. For example, the following table shows an SDO that writes the string “save”:

0	1	2	3	4	5	6	7
Control Byte	Index		Sub-index	Data			
23h	10h	10h	01h	73h = “s”	61h = “a”	76h = “v”	65h = “e”

Bit sequences are transmitted from most significant to least significant bit (big-endian format). The following example shows the bits for the value 2Bh:

7	6	5	4	3	2	1	0
0	0	1	0	1	0	1	1

CAN PROGRAMMING CONSIDERATIONS

To program the ECS, use a [Curtis programming device](#). The following considerations apply when programming the ECS:

- When a Curtis programming device is connected, the programmer uses 127 as the Node ID.
- When you change parameter values with a Curtis programming device, you do not need to use the CANopen Store Parameters object (1010h). Instead, the programming device saves parameter changes to NVM.

MESSAGE CAN-IDs

The ECS's CAN messages are identified by 11-bit CAN IDs. The ECS does not use 29-bit CAN IDs.

NMT STATE CONFIGURATION

The [Auto Operation](#) parameter indicates whether the controller automatically enters the operational or pre-operational state after initialization.

NMT, emergency, SDO, and heartbeat messages are available in both states. PDO messages are available only in the operational state.

EMERGENCY MESSAGES AND FAULTS

The ECS transmits an emergency message when a fault is generated or cleared. An emergency message is sent once per fault, and is not present while the fault remains active.

The emergency message COB-ID is the sum of 80h plus the device's node ID. Emergency messages consist of 8 bytes, which are described in the following table:

Byte(s)	Name	Description
0–1	Error Code	Indicates the fault code and the error category: Byte 0 indicates the fault code, which is in the following format: <ul style="list-style-type: none"> The four most significant bits contain the fault code's first digit. The four least significant bits contain the fault code's second digit. For example, if the fault code is 3,2, the byte's value would be 32h. Note: Fault codes are listed in Table 8 . Byte 1 indicates one of the following error categories: <ul style="list-style-type: none"> 00h = All faults are cleared FFh = Fault defined by the ECS
2	Error Register	Indicates whether any faults are active on the transmitting device: <ul style="list-style-type: none"> 00h = No active faults 01h = At least one active fault Note: The value equals the least significant bit in the Error Register object.
3–4	Fault Index	Indicates the CAN index of the Fault Record .
5	Fault Type	Indicates the fault type.
6–7	N/A	<i>Reserved.</i>

The following emergency message indicates that a fault with fault code 33 has occurred. The fault's CAN index is 2813h and the fault type is 2.

```
33 FF 01 13 28 02 00 00
```

EXPEDITED SDOs

The least significant byte of an expedited SDO is known as the *control byte*. The following table shows the control byte fields:

7	6	5	4	3	2	1	0
<i>Command Specifier</i>			0b	<i>n</i>		<i>e</i>	<i>s</i>

The following list describes the control byte:

- The *Command Specifier* field indicates the SDO's transfer type, which is described in the following table:

Transfer Type	Value
Write data to a device	001b
Confirm a write	011b
Request data from a device	010b
Device responds with requested data	010b
Abort message	100b

- Bit 4 is always 0b.
- The values of bits 0–3 depend upon whether the SDO transfers data. If the SDO does **not** contain data, these bits are always 0b. If the SDO contains data, the bit values are as follows:
 - n* indicates the number of unused data bytes.
 - e* = 1b, which indicates the message contains data.
 - s* = 1b, which indicates that the *n* field specifies the number of unused data bytes.

The following table lists the command byte values for the various transfer types:

Transfer Type	Command Byte
Write data to a device	Depends upon the data size: <ul style="list-style-type: none"> 1 byte = 2Fh 2 bytes = 2Bh 3 bytes = 27h 4 bytes = 23h
Confirm a write	60h
Request data from a device	40h
Device responds with requested data	Depends upon the data size: <ul style="list-style-type: none"> 1 byte = 4Fh 2 bytes = 4Bh 3 bytes = 47h 4 bytes = 43h
Abort message	80h

PDOs

The ECS provides two preconfigured RPDOs and two preconfigured TPDOs; for details, see [PDO1](#) and [PDO2](#). You can map other CAN objects to the preconfigured PDOs. The ECS also provides PDO3 and PDO4, which by default are not preconfigured.

The following topics describe the PDOs.

PDO Timing

The ECS's PDOs are asynchronous and are periodically transmitted and received. The ECS does not support synchronous PDOs.

A PDO's Event Time parameter indicates when the PDO transmits or is required to receive data:

- A TPDO transmits periodically using the specified time interval.
- A PDO Timeout fault occurs if an RPDO does not receive data before the Event Time expires.

Note: A TPDO also transmits data when the value of a mapped object changes.

PDO Mapping Objects

The objects for which a PDO transfers data are specified with the sub-indexes of the PDO's mapping object. Each sub-index specifies a CAN object's index, sub-index, and data length. These sub-indexes correspond to the parameters on the PDO Mapping menus.

The following table describes the mapping objects' sub-indexes:

Sub-Index	Description	PDO Mapping Menu Parameter
00h	Indicates the number of objects that the PDO maps.	Length
01h–08h	Each sub-index specifies a mapped CAN object. The bytes specify the CAN object's index, sub-index, and length.	Map 1 through Map 8

The mapped objects consist of four bytes, which are described in the following table:

Table 9 Mapped PDO Bytes

Byte(s)	Description
0–1	The object's index.
2	The object's sub-index.
3	<p>The size of the object's data, in bits. The allowed values are:</p> <ul style="list-style-type: none"> • 08h (8 bits) • 10h (16 bits) • 18h (24 bits) • 20h (32 bits) <p>Note: The ECS does not support mapping of individual bits.</p>

PDO Data Bytes

A PDO transfers a maximum of eight data bytes. The order of the bytes corresponds to the order of the PDO's mapped objects.

For example, consider the following PDO map:

TPDO1 Mapping	
Length	6
Map 1	33000010h
Map 2	33210008h
Map 3	38000008h
Map 4	4E020008h
Map 5	37070010h
Map 6	38040008h
Map 7	0h
Map 8	0h

Suppose the PDO transmits the following data:

00 08 65 00 00 00 00 00

Bytes 1–2 contain the data for the first mapped object (33000010h), byte 3 contains the second mapped object's data, and so on.

Map CAN Objects to a PDO

Take the following steps to map objects for a PDO. You can perform these steps with either SDOs or a Curtis programming device.

Note: The screen shots are from CIT.

1. Send an NMT message that changes the device to the Pre-operational state.
2. Disable the PDO by changing the COB-ID's most significant bit to 1.
3. Change the Length parameter to 0.

The following example shows the disabled PDO:

RPDO1 Setups	
RPDO1 Event Time	100 ms
RPDO1 COB ID	A46h
RPDO1 Mapping	
Length	0
Map 1	37800010h
Map 2	0h
Map 3	0h
Map 4	0h
Map 5	0h
Map 6	0h
Map 7	0h
Map 8	0h

4. For each object to be mapped, specify the object's data in a Map n parameter. The data is described in [Table 9](#).
5. Set the Length parameter to the number of mapped objects.
6. Enable the PDO by changing its COB-ID's most significant bit to 0.

The following example shows the enabled PDO, which now contains three mapped objects:

RPDO1 Setups	
RPDO1 Event Time	100 ms
RPDO1 COB ID	246h
RPDO1 Mapping	
Length	3
Map 1	37800010h
Map 2	37010008h
Map 3	37020008h
Map 4	0h
Map 5	0h
Map 6	0h
Map 7	0h
Map 8	0h

7. Send an NMT message that changes the device to the Operational state.

RPDO1

RPDO1 and TPDO1 are preconfigured to communicate with a device, such as a traction controller, that commands the ECS's relay state and interlock state. RPDO1 receives the data transmitted by the device, and TPDO1 transmits ECS data such as the user ID of the logged-on user.

To allow a CAN device to command the relay and interlock states, set the [Relay Work Mode](#) parameter to 2 and the [Interlock Type](#) parameter to 1.

RPDO1


RPDO1 is preconfigured with the Control CAN State object, which is mapped to bytes 0 and 1 and is described in the following table:

Name	Index	Sub-Index	Description	Read / Write	Data Size
Control CAN State	3780h	00h	Indicates the relay and interlock states: <ul style="list-style-type: none"> Bit 0 indicates the interlock state. Bit 1 indicates the relay state. 1b indicates on.	RW	16-bit

TPDO1

The following table describes the objects mapped to TPDO1.

Note: All the objects are read-only.

Byte(s)	Name	Index	Sub-Index	Description	Data Size
0	Logon State	3800h	00h	Indicates whether someone is logged on to the ECS. 1 indicates logged on.	8-bit
1	Present Fault Code	4E02h	00h	Indicates the current fault code. The four most significant bits indicate the fault code's first digit, the remaining bits indicate the fault code's second digit. For example, if the fault code is 32, the byte's value would be 32h. Note: If multiple faults are active, the fault codes will be transmitted in sequence.	8-bit
2–3	Data Input	3707h	00h	Indicates data entered after a user has logged on to operate the vehicle. After logon, the keypad buttons can still be used as numerical input. The data submission ends when the  button is pressed. The maximum input value is 9999; if the value exceeds 9999, the ECS clears the data.	16-bit
4	Logon User ID	3804h	00h	Indicates the user ID of the logged-on user.	8-bit

PDO2

RPDO2 and TPDO2 are preconfigured to communicate with a Curtis Instruments gauge.

RPDO2


RPDO2 receives the data transmitted by the gauge. Byte 0 is mapped to the Gauge State object, which is described in the following table. The other bytes are unmapped.

Name	Index	Sub-Index	Description	Read / Write	Data Size
Gauge State	3810h	00h	Receives data transmitted by a Curtis Instruments gauge on the CANbus. Valid values range from –128 to +127.	RW	8-bit

TPDO2

The following table describes the objects mapped to TPDO2.

Note: All the objects are read-only. Byte 7 is not mapped.

Byte(s)	Name	Index	Sub-Index	Description	Data Size
0	Control Byte	3814h	00h	Bit 0 indicates whether the buzzer is muted. 1b indicates muted. Note: The other bits are unused.	8-bit
1	Logon User ID	3804h	00h	Indicates the user ID of the logged-on user.	8-bit
2	Pushbutton Count	3813h	00h	Indicates how many keys have been pressed for the current operation.	8-bit
3	Menu State	3811h	00h	Indicates the menu state. The following values are supported: <ul style="list-style-type: none"> 0h = No one is logged on. 1Eh = A user is logged on to drive the vehicle. Other values are reserved.	8-bit
4–5	Menu Data	3812h	00h	<i>Reserved.</i>	16-bit
6	Operation State	3803h	00h	Indicates the result of the current operation: <ul style="list-style-type: none"> –5 = Cleared data. The user entered data, then cleared it by pressing the  button. –4 = Invalid RFID tag. –3 = Invalid PIN code. –2 = Operation timed out. –1 = Invalid data, such as a user name code greater than 9999, was entered. 0 = Operation is in progress. 1 = Operation succeeded. 	8-bit

STANDARD CANopen OBJECTS

The following table describes communication objects that are defined by the CANopen standard.

Name	Index	Sub-Index	Description	Read / Write	Values Data Size
Device Type	1000h	00h	Indicates whether a device follows a standard CiA device profile. The ECS does not follow a standard CiA profile, so the value is 0.	RO	0 32-bit
Error Register	1001h	00h	Indicates if a fault is active: 0 = No active fault 1 = One or more active faults	RO	0–1 8-bit
Error History	1003h	Contains data for the 4 most recent faults.			
		00h	Indicates the index of the oldest fault. Writing 0 to sub-index 00h clears the fault log. For details, see Error History Object (1003h) .	RW	0–4 8-bit
		01h–04h	Provide data on the most recent faults.	RO	0–4294967295 32-bit
Manufacturer Device Name	1008h	00h	Initiates a segmented SDO upload that indicates the ECS's model name and number as an ASCII string.	RO	String
Store Parameters	1010h	01h	Saves the current parameter values to NVM. The data bytes must represent the string "save".	RW	0–2147483647 32-bit
Restore Default Parameters	1011h	01h	Restores parameters to their default values. The data bytes must represent the string "load".	RW	0–2147483647 32-bit
Emergency COB ID	1014h	00h	Indicates the Emergency Message COB-ID.	RO	0–16777215 32-bit
Emergency Message Inhibit Time	1015h	00h	Indicates the inhibit time, which is the minimum time that must elapse between emergency messages. The resolution is 100µs and the minimum step size is 1ms. For example, 120ms is specified as 1Eh.	RW	14–400ms 16-bit
Heartbeat Rate	1017h	00h	Specifies the cyclic rate of the ECS's heartbeat messages. Note: This object is the Heartbeat Rate parameter on the CAN Interface menu.	RW	16–200ms 16-bit
Identity Object	1018h	Provides information on the ECS.			
		01h	Indicates the CiA-assigned identifier of Curtis Instruments, which is 4349h.	RO	4349h 32-bit
		02h	Indicates a code that uniquely identifies the device.	RO	0–4294967295 32-bit
		03h	Indicates the ECS's Curtis CAN protocol version. The upper two bytes contain the major version and the lower two bytes contain the minor version.	RO	0–4294967295 32-bit
		04h	<i>Reserved.</i>	N/A	N/A
		05h	Initiates a segmented SDO upload that indicates the manufacturing location as an ASCII string.	RO	String

Name	Index	Sub-Index	Description	Read / Write	Values Data Size
EDS	1021h	00h	Initiates a block upload of the EDS.	RO	–2147483648 to +2147483647 32-bit
EDS Storage Format	1022h	00h	Indicates the EDS file's storage format: <ul style="list-style-type: none"> • 00h = Standard EDS, not compressed • 80h = Standard EDS, compressed zip Note: Other values are reserved for future use.	RO	–2147483648 to +2147483647 32-bit

Error History Object (1003h)

The CANopen Error History object at index 1003h provides data on the four most recently detected faults. The sub-indexes correspond to the order in which the faults occurred. Sub-index 01h records the most recent fault, sub-index 02h records the second most recent fault, etc.

The fault data consists of four bytes, which are described in the following table:

Byte(s)	Description
0–1	Contains an error category and the fault code: Byte 0 indicates the fault code, which is in the following format: <ul style="list-style-type: none"> • The 4 most significant bits indicate the fault code's first digit. • The 4 least significant bits indicate the fault code's second digit. For example, if the fault code is 32, the byte's value would be 32h. Byte 1 indicates the error category, which is one of the following: <ul style="list-style-type: none"> • 00h = All faults are cleared • FFh = ECS fault
2–3	Indicates how many hours the fault occurred after the ECS's internal hourmeter was set to 0. The hourmeter is set to 0 when the ECS is first powered up. After 65,335 hours of running time have elapsed, the hourmeter is reset to 0.

The data bytes in the following SDO indicate that the most recent fault has a fault code of 33 and that the fault occurred 86 hours after the hourmeter was set to 0.

```
43 03 10 01 33 FF 56 00
```

PASS-THROUGH MODE


When the ECS is operating in pass-through mode, the buzzer and LEDs can be controlled with CANopen messages.

Control the Buzzer

When the ECS is operating in pass-through mode and the Tone Control Enable via CAN parameter is set to On, the buzzer is controlled by the ToneControlByte CAN object:

NAME	INDEX	DATA SIZE	DESCRIPTION
ToneControlByte	0x5904:01	8-bit	<p>The following values control the buzzer. All other values are ignored:</p> <ul style="list-style-type: none"> • 0x00: No sound. • 0x01: Error sound. • 0x02: Success sound. <p>If the value is non-zero, the buzzer sounds once. To sound the buzzer with another CAN message, first set ToneControlByte to 0, otherwise subsequent commands are ignored.</p> <p>If the value is 0, the buzzer operates in its normal mode.</p>

The following considerations apply when the Tone Control Enable via CAN parameter is set to On:

- The buzzer does not sound when an RFID tag is swiped.
- The buzzer does not sound when a user presses the  button after making keypad entries.

Note: The buzzer still sounds the Pushbutton sound when a key is pressed.

- If ToneControlByte is non-zero and the PDO Timeout fault is active, the buzzer operates in its normal mode until the fault is cleared.

Control the LEDs

When the ECS is operating in pass-through mode and the LED Control Enable via CAN parameter is set to On, the LEDs are controlled by the RedLEDControlByte and GreenLEDControlByte CAN objects:

NAME	INDEX	DATA SIZE	DESCRIPTION
RedLEDControlByte	5905:01	8-bit	<p>Commands the red LED:</p> <ul style="list-style-type: none"> • 0x00: The LED is off. • 0x01: The LED continuously flashes, with the LED on for 0.64 seconds, then off for 0.64 seconds. • 0xFF: The LED is on without flashing. <p>If a value other than those listed above is specified, the LED remains in its current state.</p>
GreenLEDControlByte	5905:02	8-bit	<p>Commands the green LED:</p> <ul style="list-style-type: none"> • 0x00: The LED is off. • 0x01: The LED continuously flashes, with the LED on for 4.992 seconds, then off for 0.96 seconds. • 0xFF: The LED is on without flashing. <p>If a value other than those listed above is specified, the LED remains in its current state.</p>

The following considerations apply when the LED Control Enable via CAN parameter is set to On:

- If both RedLEDControlByte and GreenLEDControlByte are set to 0, the LEDs operate in their normal modes.
- If RedLEDControlByte or GreenLEDControlByte is set to a non-zero value and a fault is active, the LEDs flash the fault code until the fault is cleared.
- Regardless of the RedLEDControlByte value, the red LED flashes once when a key is pressed, then reverts to the state specified by RedLEDControlByte.

10 — SUPERVISOR OPERATION WITH THE KEYPAD

This chapter describes the tasks that the supervisor can perform with the keypad. These tasks include adding users, deleting users, and changing some parameter values.



Note: You can also add and delete users with Curtis programming devices. See [Manage Users with Curtis Programming Devices](#).





SUPERVISOR MANAGEMENT MENU

The Supervisor Management menu contains submenus for changing the supervisor's PIN code, tag, and user name code, adding and managing users, and configuring the ECS. Only the supervisor can access the Supervisor Management menu.

The following table describes the Supervisor Management menu's submenus.


Menu Number	Description
1	Change the supervisor's PIN code. CAUTION: The default supervisor PIN code is 123456. For security reasons, change the default PIN code as soon as possible.
2	Change the supervisor's RFID tag.
3	Change the supervisor's user name code.
4	Manage users with the Add and Delete Users menu.
5	Delete the supervisor's RFID tag.
6	Program parameters.
7	Show the user ID of the last user to log on.
8	Show the first available user ID.
9	Calibrate the antenna.


The following list describes how the  and  buttons and the LEDs work when the ECS is on the Supervisor Management submenus:


- To access a menu, press the menu number, then press .
- When you access most of the menus, the red LED remains on without flashing and the green LED flashes the menu number every two seconds.
Note: Menus 7 and 8 flash user IDs.
- When you are working on a menu, the  button has two uses:
 - If you have entered data, pressing  clears the data. If data has been cleared, the buzzer sounds the [Clear Data sound](#) and the ECS remains on the submenu.
 - If there is no data to clear, pressing  returns to the previous menu. To indicate this, the buzzer sounds the [Return sound](#).

LOG ONTO THE SUPERVISOR MANAGEMENT MENU

Take the following steps to log onto the Supervisor Management menu.

1. Press and hold the  button for two seconds, until you hear the [Pushbutton sound](#) and the red LED starts flashing.

Red	Green
	

2. Perform one of the following steps:
 - Place your user tag in front of the ECS until the buzzer sounds the [Success sound](#).
 - Enter 00 and the supervisor's PIN code, then press . ECS accesses the Supervisor Management menu and the buzzer sounds the Success sound.

Note: 00 is the ECS supervisor's user ID.


Red	Green
	

3. Use the Supervisor Management menu to perform any of the following tasks, in any order:
 - [Manage the Supervisor's PIN Code, RFID Tag, and User Name Code](#)
 - [Manage Users](#)
 - [Program Parameters with the Keypad](#)
 - [Show the Last User's ID](#)
 - [Find the First Available User ID](#)
 - [Calibrate the Antenna](#)

Note: If the ECS doesn't detect keypad activity for five minutes, it automatically logs off and returns to the idle state.

4. Once you have finished working with the Supervisor Management menu, press  to log off.

After you log off, the LEDs typically will indicate that the ECS is operating normally:

Red	Green
	

However, if you have changed a parameter that requires the ECS to be restarted, the ECS generates a Parameter Change fault and the LEDs flash the fault code, which is 33:

Red	Green
  	  

To clear the fault, restart ECS.

MANAGE THE SUPERVISOR'S PIN CODE, RFID TAG, AND USER NAME CODE

Take the following steps to manage the supervisor's PIN code, RFID tag, and user name code.

CAUTION

The default supervisor PIN code is 123456. For security reasons, change the default PIN code as soon as possible.

1. Access the [Supervisor Management menu](#).
2. You can now perform any or all of the tasks listed in the following headings. The tasks can be performed in any order:

Change the Supervisor's PIN Code

- a. Press 1, then press .

Red	Green
	




- b. Enter the new PIN code.

Note: The supervisor PIN code must have 4–8 digits.

- c. Press  to save the PIN code and return to the Supervisor Management menu.

Change the Supervisor's RFID Tag

- a. Press 2, then press .


Red	Green
	 

- b. Place the tag front of the ECS until the buzzer sounds the Success sound. The ECS returns the Supervisor Management menu.

Change the Supervisor's User Name Code

- a. Press 3, then press .

Red	Green
	  

- b. Enter the user name code, which can be any number between 1–9999.
- c. Press  to save the user name code and return to the Supervisor Management menu.

Delete the Supervisor's RFID Tag









Press 5, then press . The ECS returns to the Supervisor Management menu.

MANAGE USERS

The supervisor authorizes access for a user by adding an RFID tag, PIN code, or both, to a user ID. The supervisor can also delete a user's tag and/or PIN code. The following topics describe how to add and remove RFID tags and PIN codes.

User Statuses and the LEDs

When you add or delete a user's PIN code or RFID tag, the LEDs flash the user's status: the green LED remains on without flashing, and the red LED flashes the user status number every two seconds. The following table describes the flash sequences:

User Status	Description	Red	Green
1	The user has neither a PIN code nor an RFID tag.		
2	The user only has a PIN code.		
3	The user only has an RFID tag.		
4	The user has both a PIN code and an RFID tag.		

Add/Delete Users Menu

The supervisor uses the Add/Delete Users menu to add and delete users' RFID tags and PIN codes. The first step after accessing the Add/Delete Users menu is to enter the user ID to be managed. The LEDs indicate whether a user ID has been entered:

- If a user ID has not been entered, the red LED remains on without flashing and the green LED flashes the menu number.
- If a user ID has been entered, the red LED flashes the user status and the green LED remains on without flashing.



The following table describes the submenus of the Add/Delete Users menu.

Menu Number	Description
1	Create PIN code.
2	Create RFID tag.
3	Delete PIN code.
4	Delete RFID tag.
5	Delete user.

Note: The Add/Delete Users menu cannot be used to create a tag for a user that already has a tag, a PIN code for a user that already has a PIN code, or a user name code. A user's credentials can only be changed by the user.






Add and Delete PIN Codes, RFID Tags, and Users


Take the following steps to add and delete PIN codes, tags, and users.

1. If you are not on the Supervisor Management menu, access it. See [Log Onto the Supervisor Management Menu](#).
2. To find the lowest available user ID, take the following steps:
 - a. Press 8, then press . The red LED flashes the user ID's first digit and the green LED flashes the second digit.
Note: If a digit is 0, the corresponding LED is off.
 - b. Press  to return to the Supervisor Management menu.

Red	Green
	

3. Press 4, then press  to access the Add/Delete Users menu.

Red	Green
	   

4. For each user that you'll be working on, take the following steps:
 - a. Enter the user ID, then press . The LEDs flash the user status.
Note: If the user ID is 1–9, enter 0 before the digit. For example, if the user ID is 3, enter 03.
 - b. You can now perform any or all of the tasks listed in the following headings. The tasks can be performed in any order:


Create the PIN Code

Press 1, then press . The LEDs flash the updated user status and the ECS returns to the Add/Delete Users menu.



The default PIN code is 1234. The user should change the PIN code.

Create the RFID Tag

- i. Press 2, then press . The LEDs flash the user status.
- ii. Place the tag in front of the ECS until the buzzer sounds the Success sound. The LEDs flash the updated user status and the ECS returns to the Add/Delete Users menu.


Delete the PIN Code


Press 3, then press . The LEDs flash the updated user status and the ECS returns to the Add/Delete Users menu.

Delete the RFID Tag

Press 4, then press . The LEDs flash the updated user status and the ECS returns to the Add/Delete Users menu.


Delete the User


Press 5, then press . The LEDs flash the updated user status and the ECS returns to the Add/Delete Users menu.

- c. Once you have finished working with the user, press  to clear the user ID. The ECS remains on the Add/Delete users menu.

Red	Green
	

- d. To work with another user, repeat these steps, starting with step 4.a.

- 5. Once you have finished working with users, press  to return to the Supervisor Management menu.

Red	Green
	

PROGRAM PARAMETERS WITH THE KEYPAD


You can use the keypad's Programming menu to change the values of several parameters. The Programming menu is menu 6 on the Supervisor Management menu. The following table describes the menus on the Programming menu:



Menu Number	Parameter
1	Baud Rate
2	Node ID
3	Interlock Type
4	Logoff Time
5	Mute Enable
6	Relay Work Mode
7	RFID Swipes Logoff Enable

When you access one of these menus, the red LED flashes the menu number and the green LED remains on without flashing.

Access the Programming Menu

Take the following steps to access the Programming menu:

1. If you are not on the Supervisor Management menu, access it. See [Log Onto the Supervisor Management Menu](#).
2. Press 6, then press  to access the Programming menu.

Red	Green
	

3. The following procedures describe how to program the parameters. If you need to program multiple parameters, the procedures can be performed in any order:
 - [Change the Baud Rate Parameter](#)
 - [Change the Node ID Parameter](#)
 - [Change the Interlock Type Parameter](#)
 - [Change the Logoff Time Parameter](#)
 - [Change the Mute Enable Parameter](#)
 - [Change the Relay Work Mode Parameter](#)
 - [Change the RFID Swipes Logoff Enable Parameter](#)

Note: After you change a parameter, the ECS returns to the Programming menu.


4. Once you have finished changing parameters, press  to return to the Supervisor Management menu.



Red	Green
	

Note: If you have changed a parameter that requires the ECS to be restarted, the ECS will generate a Parameter Change fault and flash its fault code (33) after you log off from the Supervisor Management menu.

Change the Baud Rate Parameter


Take the following steps to change the [Baud Rate](#) parameter:

1. If you are not on the Programming menu, perform the steps in [Access the Programming Menu](#).
2. Press 1, then press .

Red	Green
	

3. Specify one of the following values:
 - 0 = 125 Kbps
 - 1 = 250 Kbps
 - 2 = 500 Kbps
 - 3 = 800 Kbps
 - 4 = 1 Mbps

Note: The ECS also supports the 100 Kbps baud rate. However, you cannot specify 100 Kbps with the keypad. To specify 100 Kbps, use an SDO or a Curtis programming device.


4. Press  to apply the parameter value. The ECS returns to the Programming menu.



Red	Green
	

Note: When you log off from the Supervisor Management menu, the ECS will generate a Parameter Change fault (type 1).

Change the Node ID Parameter


Take the following steps to change the [Node ID](#) parameter:

1. If you are not on the Programming menu, perform the steps in [Access the Programming Menu](#).
2. Press 2, then press .

Red	Green
	

3. Enter the new node ID, which must be between 1–126.

Note: Node ID 0 is reserved by CANopen, and Node ID 127 is reserved for Curtis programming devices.


4. Press  to apply the parameter value. The ECS returns to the Programming menu.

Red	Green
	

Note: When you log off from the Supervisor Management menu, the ECS will generate a Parameter Change fault (type 1).

Change the Interlock Type Parameter

Take the following steps to change the [Interlock Type](#) parameter:



1. If you are not on the Programming menu, perform the steps in [Access the Programming Menu](#).
2. Press 3, then press .

Red	Green
	

3. Specify the parameter value:


- 0 = Interlock input (pin 2)
- 1 = RPDO1



4. Press  to apply the parameter value. The ECS returns to the Programming menu.


Red	Green
	

Change the Logoff Time Parameter

Take the following steps to change the [Logoff Time](#) parameter:

1. If you are not on the Programming menu, perform the steps in [Access the Programming Menu](#).
2. Press 4, then press .


Red	Green
	

3. Enter the logoff time, in minutes. The maximum value is 255 minutes. To disable the automatic log off, press 0.
4. Press  to apply the parameter value. The ECS returns to the Programming menu.

Red	Green
	

Change the Mute Enable Parameter


Take the following steps to change the [Mute Enable](#) parameter:








1. If you are not on the Programming menu, perform the steps in [Access the Programming Menu](#).
2. Press 5, then press .

Red	Green
	

3. Specify one of the following values:


- 0 = Audible
- 1 = Muted

4. Press  to apply the parameter value. The ECS returns to the Programming menu.


Red	Green
	     








Change the Relay Work Mode Parameter

Take the following steps to change the [Relay Work Mode](#) parameter:

1. If you are not on the Programming menu, perform the steps in [Access the Programming Menu](#).
2. Press 6, then press .

Red	Green
     	


3. Specify one of the following values:
 - 0 = Disable relay output.
 - 1 = Engage and disengage the relay when an authorized user logs on or off.
 - 2 = Engage and disengage the relay with the Control CAN State object.
4. Press  to apply the parameter value. The ECS returns to the Programming menu.









Red	Green
	     


Note: When you log off from the Supervisor Management menu, the ECS will generate a Parameter Change fault (type 1).

Change the RFID Swipes Logoff Enable Parameter

Take the following steps to change the [RFID Swipes Logoff Enable](#) parameter:

1. If you are not on the Programming menu, perform the steps in [Access the Programming Menu](#).
2. Press 7, then press .


Red	Green
      	

3. Specify one of the following values:
 - 0 = Disable automatic logoff when swiping the same card.
 - 1 = Enable automatic logoff when swiping the same card.
4. Press  to apply the parameter value. The ECS returns to the Programming menu.

Red	Green
	     


SHOW THE LAST USER'S ID

Take the following steps to have the LEDs flash the user ID of the last user to log onto the ECS:

1. Access the [Supervisor Management menu](#).
2. Press 7, then press . The red LED flashes the user ID's first digit and the green LED flashes the second digit. If a digit is 0, the corresponding LED is off. The flash sequence is repeated until you exit the menu.

Note: If the supervisor was the last user, both LEDs are on without flashing.





3. Press  to return to the Supervisor Management menu.

Red	Green
	



FIND THE FIRST AVAILABLE USER ID

Menu 8 on the Supervisor Management menu flashes the lowest user ID that has neither an RFID tag nor a PIN code. To indicate the user ID, the red LED flashes the user ID's first digit and the green LED flashes the second digit. The flash sequence is repeated until you exit the menu.

If a digit is 0, the corresponding LED is off. For example, if the red LED is off and the green LED flashes four times, the lowest available user ID is 04:

Red	Green
	   


Take the following steps to find the lowest available user ID.


1. Access the [Supervisor Management menu](#).
2. Press 8, then press . The red LED flashes the user ID's first digit and the green LED flashes the second digit.
3. Press  to return to the Supervisor Management menu.

Red	Green
	

CALIBRATE THE ANTENNA

Take the following steps to calibrate the antenna's field strength level so that the ECS automatically detects the best channel for RFID recognition.

1. Access the [Supervisor Management menu](#).
2. Press 9, then press . When the ECS finishes calibrating, the buzzer sounds the Success sound and the ECS generates a Parameter Change fault (type 2). The LEDs flash the fault code, which is 33:

Red	Green
  	  

3. To clear the fault, restart ECS.

11 — MANAGE USERS WITH CURTIS PROGRAMMING DEVICES

You can use a [Curtis programming device](#) to work with PIN codes, RFID tags, and user name codes. The following menus provide parameters for working with user credentials:

- Supervisor Management menu
- Logon User Setup menu

The following topics describe how to use these menus.

USE THE SUPERVISOR MANAGEMENT MENU

The Supervisor Management menu provides parameters for adding PIN codes, adding RFID tags, and deleting users; for information on the parameters, see [Supervisor Management Menu](#).

Note: The keypad also contains a menu named Supervisor Management.

Take the following steps to use this menu:

1. Log onto the **keypad's** Supervisor Management menu. See [Log Onto the Supervisor Management Menu](#).
2. In the Curtis programming device, select the Supervisor Management menu.
3. Set the Target User ID parameter to the user ID to be managed. The Target User State parameter indicates the user's status.

Note: The First Free User ID parameter indicates the lowest available user ID.

4. For the specified Target User ID, you can perform any or all of the tasks listed in the following headings. The tasks can be performed in any order:

Create a PIN Code

Set the Create Target User PIN Code parameter to On. The buzzer sounds the Success sound and the Target User State parameter indicates the updated user status.



CAUTION

The default PIN code is 1234. For security reasons, the user should change the PIN code as soon as possible.


Create an RFID Tag

- a. Set the Create Target User RFID Tag parameter to On.
- b. Place the tag in front of the ECS until the buzzer sounds the Success sound. The Target User State parameter indicates the updated user status.

Delete a User

Set the Delete Target User parameter to On. The buzzer sounds the Success sound and the Target User State parameter indicates the updated user status.

Note: The Delete Target User parameter deletes the user's PIN code and/or RFID tag.

5. To work with another user ID, repeat steps 3 and 4.
6. Press  to log off.

USE THE LOGON USER SETUP MENU

The Logon User Setup menu provides parameters for changing a user's PIN code, RFID tag, and/or user name code; see [Logon User Setup Menu](#). The parameters apply to the logged-on user. Take the following steps to use this menu:

1. Log onto the keypad's User Management menu. See [User Management Menu](#).

Note: The Logon User Setup menu is also available when the ECS supervisor is logged on.

2. In the Curtis programming device, select the Logon User Management menu, then select the Logon User Setup menu.
3. You can now perform any or all of the tasks listed in the following headings. The tasks can be performed in any order:

Add or Change the PIN Code

- a. In the New PIN Code parameter, specify 9 followed by the PIN code. For example, if the PIN code is 2468, specify 92468.

The supervisor PIN code must be 4–8 digits, and PIN codes for other user IDs must be 2–6 digits.

Note: If you did not specify 9 before the PIN code, the buzzer sounds the [Error sound](#) to indicate that the PIN code was not changed.

- b. Set the Save New PIN Code parameter to On. The buzzer sounds the Success sound.

Add or Change the RFID Tag

- a. Set the New RFID Tag parameter to On.
- b. Place the tag in front of the ECS until the buzzer sounds the Success sound.

Delete the RFID Tag

Set the Delete RFID Tag parameter to On. The buzzer sounds the Success sound.

Add or Change the User Name Code

- a. In the New Name Code parameter, specify 9 followed by the user name code. The user name code can be any number between 1–9999.

For example, if the user name code is 1357, specify 91357.

- b. Set the Save New Name Code parameter to On. The buzzer sounds the Success sound.

Note: If you did not specify 9 before the user name code, the user name code is not changed and the buzzer sounds the Error sound.

4. Press  to log off.

APPENDIX A – CURTIS PROGRAMMING DEVICES

Curtis programming devices provide programming, diagnostic, and test capabilities for Curtis CAN devices. Two programming devices are available for the ECS:

- 1313 handheld programmer
- Curtis Integrated Toolkit™ (CIT)

CIT has the advantage of a large, easy-to-read screen. On the other hand, the 1313 handheld programmer is more portable, making it convenient for working in the field.

The programming devices include the following features:

- **Parameter adjustment.** Save and restore the values of programmable parameters.
- **Monitoring:** Display real-time values during vehicle operation. These values include data for inputs and outputs.
- **Diagnostics and troubleshooting:** Display active faults and the fault history, and clear the fault history.
- **Flashing:** Update firmware of Curtis devices.

The programmers are available for the following access levels. The bullets are sorted from the highest to lowest access level:

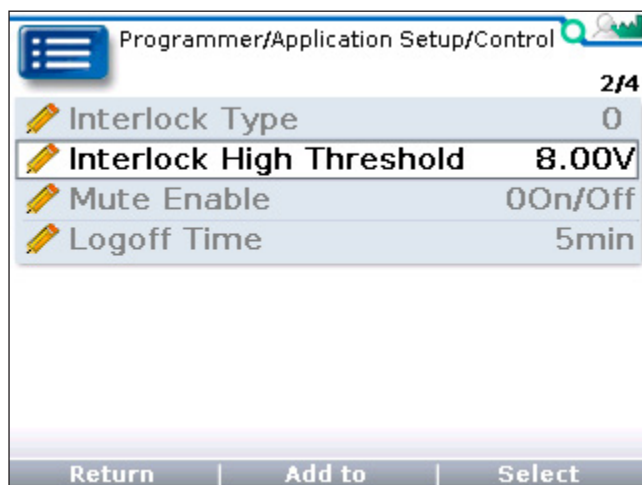
- OEM Factory
- OEM Dealer
- Field Advanced
- Field Intermediate
- Field Basic

A Curtis programmer can perform the actions available at or below its access level. For example, a Field Basic programmer can only perform actions available for the Field Basic access level, while an OEM Factory programmer can perform all actions available for any of these access levels.

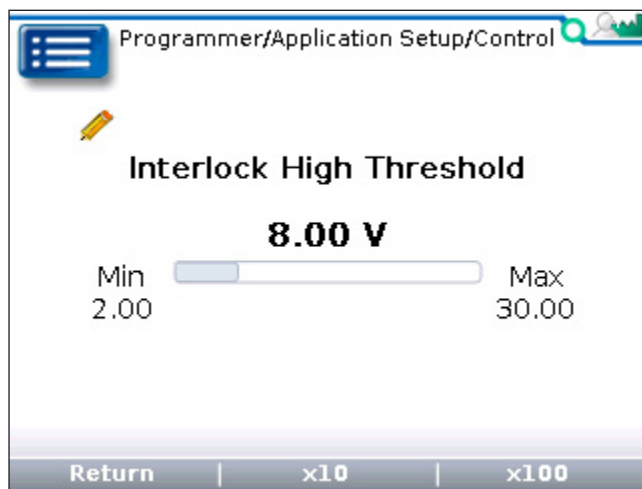
The following example shows the Control menu in the CIT Programmer application. You can view or edit a parameter by selecting it on the left-hand side. You can also view and edit all of a menu's parameters in one window by selecting the menu as shown below:

Device...		Name	Device Value	Project Value	Min Value	Max Value
Control		Interlock Type	0	0	0	1
Interlock Type	0	Interlock High Thresh..	8.00 V	8.00 V	2.00 V	30.00 V
Interlock High Thresh..	8.00 V	Mute Enable	Off	Off	Off	On
Mute Enable	Off	Logoff Time	5 min	30 min	0 min	255 min
Logoff Time	5 min					

The following example shows the Control menu in the Curtis 1313 handheld programmer:



To edit a parameter, select the parameter:



For more information on the 1313 programmer and CIT, see <https://www.curtisinstruments.com/products/programming/>.

APPENDIX B — SPECIFICATIONS

Nominal Voltage	12–96VDC
Minimum Voltage	9VDC
Maximum Voltage	120VDC
Operating Current	32–248mA
Tag Reader	Supports ISO 14443A RFID tags.
Dimensions (W × L × H)	70 x 102 x 34 mm
Operating Temperature	–40°C to +70°C Note: The operating temperature for RFID tags is –20°C to +50°C.
Storage Temperature	–40°C to +85°C Note: The storage temperature for RFID tags is –40°C to +70°C.
Humidity	Designed to the following requirements: <ul style="list-style-type: none"> • Soak: EN 60068-2-78 • Cyclic: EN 60068-2-30
Ingress Protection	Designed to the requirements of EN 60529: <ul style="list-style-type: none"> • Face is sealed to IP65. • Rear is sealed to IP65 for electronic components and to IP40 for the connector. Optional parts can increase the connector's protection to IP54.
Salt Spray	Designed to the requirements of ASTM B117.
Shock	Designed to the requirements of EN 60068-2-27.
Vibration	Designed to the following requirements: <ul style="list-style-type: none"> • General: EN 60068-2-6 • Random: EN 60068-2-64 • Resonance: EN 60068-2-6
EMC	Designed to the following requirements: <ul style="list-style-type: none"> • Emissions: <ul style="list-style-type: none"> • Radiated Emissions: EN 12895: 2015 • Conducted Emissions: EN 301 489-1 V2.2.1 • Immunity: EN12895: 2015 • Radio Frequency: EN 300 330 V2.1.1
*CE	Designed to the following requirements: <ul style="list-style-type: none"> • EMC: EN 12895: 2015, EN 301 489-1 V2.2.1 • RoHS: RoHS directive 2015/863/EU (RoHS 3)
*UL	UL recognized component per UL583.
Encodement	The following list describes part and model number encodement: <ul style="list-style-type: none"> • Part Number: 17731700-XXXX • Model Number: ECS-XXXX <p>17731700 is the family number and ECS is the family code. X indicates the logo type with one of the following values:</p> <ul style="list-style-type: none"> • C = Curtis logo • U = Customer logo • N = No logo <p>YYY is a sequential numeric code.</p>

* Pending

Note: Regulatory compliance of the complete system with the ECS installed is the responsibility of the OEM.