

EMIT Data Relay

Installation, Operation, and Troubleshooting Manual

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C1D2 Notice

This module must be installed in a C1D2-suitable enclosure that is IP54 rated or better and protects the module from being accessed in normal operation without using a tool. The enclosure should suitably protect the equipment from deterioration that would affect its suitability for Class I, Division 2 locations.

EMIT Data Relay (EDR)
P/N: 20410 12-30V, 2A
Class 1, Div. 2, Groups A, B, C, & D
T4 Ambient Temp. -40 to 149°F (-40 to 65°C)
Conforms to ANSI/ISA Std 12.12.01
Certified to CSA Std C22.2 No. 213
WARNING: SEE INSTRUCTION MANUAL
ATTENTION: CONSULTER LE MANUEL D'INSTRUCTIONS

ETL CLASSIFIED
C ETL LISTED US
Intertek
4008500

Standards

Nonincendive Electrical Equipment For Use In Class I And II, Division 2 And Class III, Divisions 1 And 2 Hazardous (Classified) Locations [ISA 12.12.01:2015]

Nonincendive Electrical Equipment For Use In Class I And II, Division 2 And Class III, Divisions 1 And 2 Hazardous (Classified) Locations [CSA C22.2#213:2016 Ed.2]

WARNING

IT IS IMPORTANT TO READ AND UNDERSTAND ALL THE INSTRUCTIONS AND WARNINGS LISTED IN THIS MANUAL BEFORE USING OR INSTALLING THE SYSTEM.

FAILURE TO FOLLOW INSTALLATION INSTRUCTIONS MAY LEAD TO ENGINE DAMAGE AND PERSONAL INJURY TO OPERATORS OR NEARBY PERSONNEL.

EXPLOSION HAZARD - DO NOT DISCONNECT WHILE CIRCUIT IS LIVE UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS.

DO NOT OPEN OR REMOVE COVER UNLESS THE POWER IS DE-ENERGIZED OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS 1, DIVISION 2.

THE INSTALLER SHOULD BE FAMILIAR WITH AND OBSERVE ALL LOCAL, STATE, AND FEDERAL CODES.

ATTENTION

IL EST IMPORTANT DE LIRE ET COMPRENDRE TOUTES LES INSTRUCTIONS ET MISES EN GARDE CONTENUES DANS CE MANUEL AVENT D'UTILISER OU D'INSTALLER LE SYSTÈME.

LE NON-RESPECT DES INSTRUCTIONS D'INSTALLATION PEUT ENTAÎNER DES DOMMAGES AU MOTEUR ET DE BLESSURES POUR LES OPÉRATEURS OU LE PERSONNEL À PROXIMITÉ.

RISQUE D'EXPLOSION – NE PAS DÉBRANCHER LORSQUE LE CIRCUIT EST SOUS TENSION SAUF SI RÉGION EST CONNU POUR ÊTRE NON DANGEREUX.

NE PAS OUVRIR LE CAPOT OU MOINS QUE LE ALIMENTATION EST COUPÉE OU DE LA RÉGION EST CONNUE POUR ETRE NON DANGEREUX.

RISQUE D'EXPLOSION – SUBSTITUTION DE COMPOSANTS PEUT NUIRE À LA CONFORMITÉ CLASSE 1, DIVISION 2.

L'INSTALLATEUR DOIT CONNAÎTRE ET RESPECTER TOUTES LES RÉGLEMENTATIONS LOCALES, ÉTATIQUES ET FÉDÉRALES CODES.

Hardware and System Overview

The EMIT Data Relay (EDR) is a module for interfacing non-EMIT control system data to EMIT's telematics platform. Non-EMIT systems include popular compressor control annunciators and engine control units. The EDR connects to these systems via MODBUS and propriety protocols, organizes the data, and transmits the data via cellular modem to a customer facing database for remote observation.

Power

- 12 – 30VDC power supply input range
- Maximum power consumption: 30W

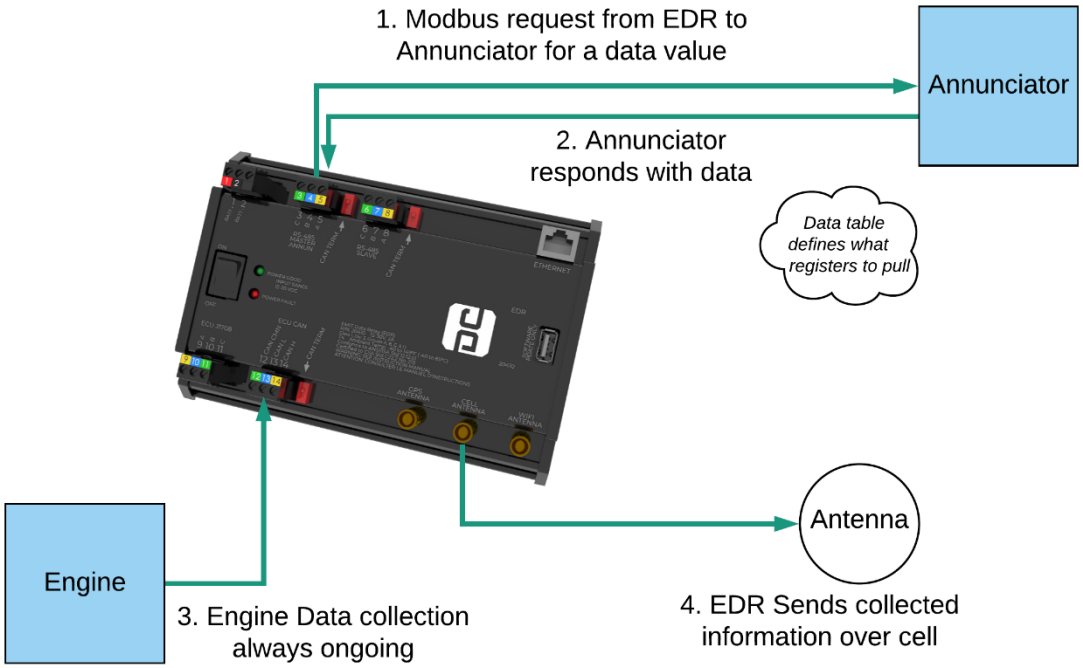
Environmental

- Temperature: -40°C to +65°C (-40°F to 149°F) T4
- Humidity: 5% - 90%, non-condensing

Communication

- USB host for datalog access and software updates
- RS-485 half-duplex MODBUS RTU Master for panel annunciator communication
- RS-485 half-duplex MODBUS RTU Slave for spare or expansion
- Ethernet port for Modbus/TCP access
- ECU J1708 and ECU CAN for Caterpillar ADEM access
- Wi-Fi Antenna for local wireless access to unit information
- Cell module for remote data collection and callouts
- GPS for location service & accurate time

General System Concepts



In the most typical use case, the Data Relay acts as a “Modbus Master” to a non-EMIT panel system. Using some defined data tables, the Data Relay will request data values such as suction pressure, oil temp, etc., from the panel system via RS-485 Modbus or Modbus/TCP.

Each Modbus data value is configured by specifying a target *Register* and *Slave ID* of the source of the information (typically the panel annunciator). For example, the **suction pressure** might be present at Slave ID 10, Register 41001. The Data Relay will request for Register 41001 from Slave ID 10, the annunciator will respond with the data, and the Data Relay will store this response as “Suction Pressure”.

This data is accumulated into standard blocks of information and then sent to EMIT Data Services via cell connection. This also includes run status information for the purposes of sending callouts. Additionally, the Data Relay will collect engine data from an engine control unit, such as Caterpillar ADEM ®, which will also be sent to the server.

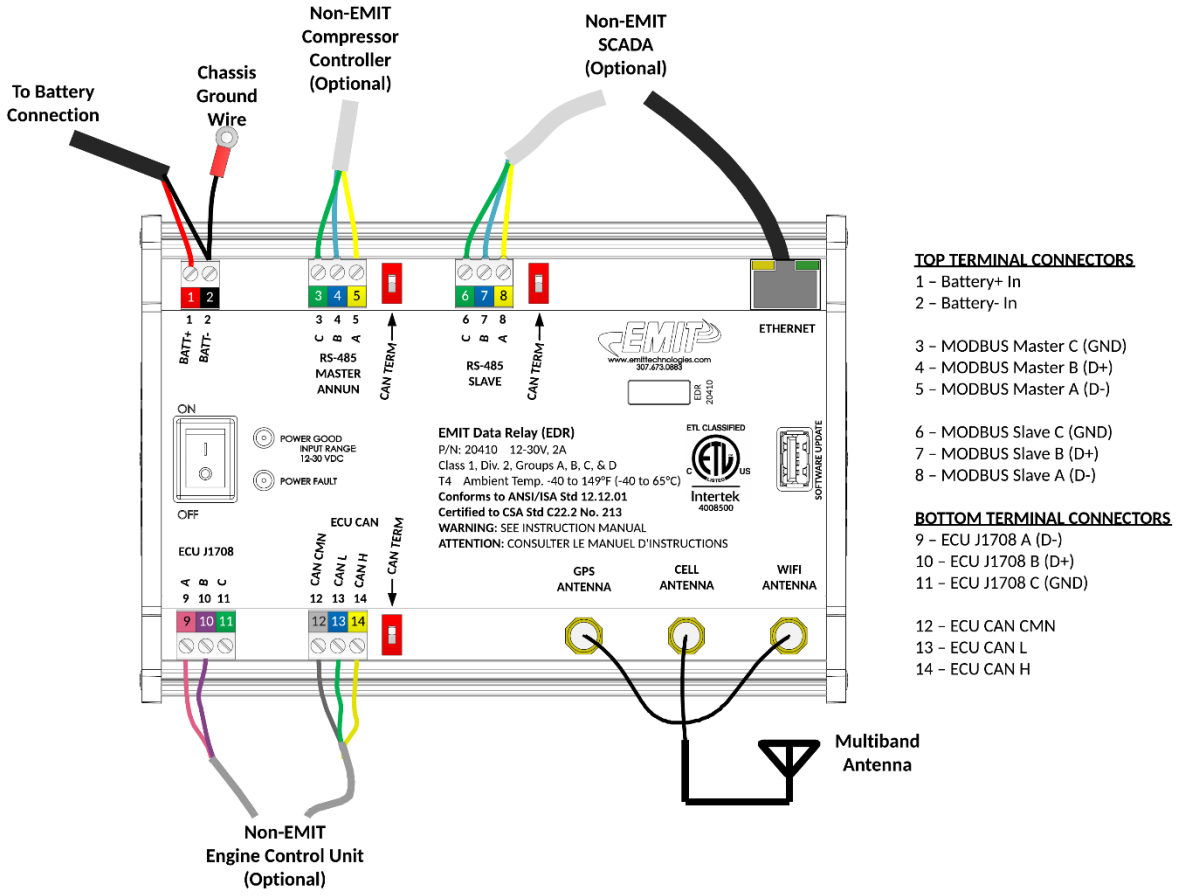
Separately, the Data Relay can operate as a Modbus Slave device. In this scenario, another SCADA system uses the Data Relay only for engine data translation.

Wiring

NOTE: Do not connect, disconnect, or otherwise alter any wiring unless power is removed and area is known to be non-hazardous.

NOTE: The connections should be protected from access inside the panel by some tool-required latch.

A general wiring diagram of all possible connections is shown below. In most cases some subset of these connections will be used.



TOP TERMINAL CONNECTORS
1 – Battery+ In
2 – Battery- In

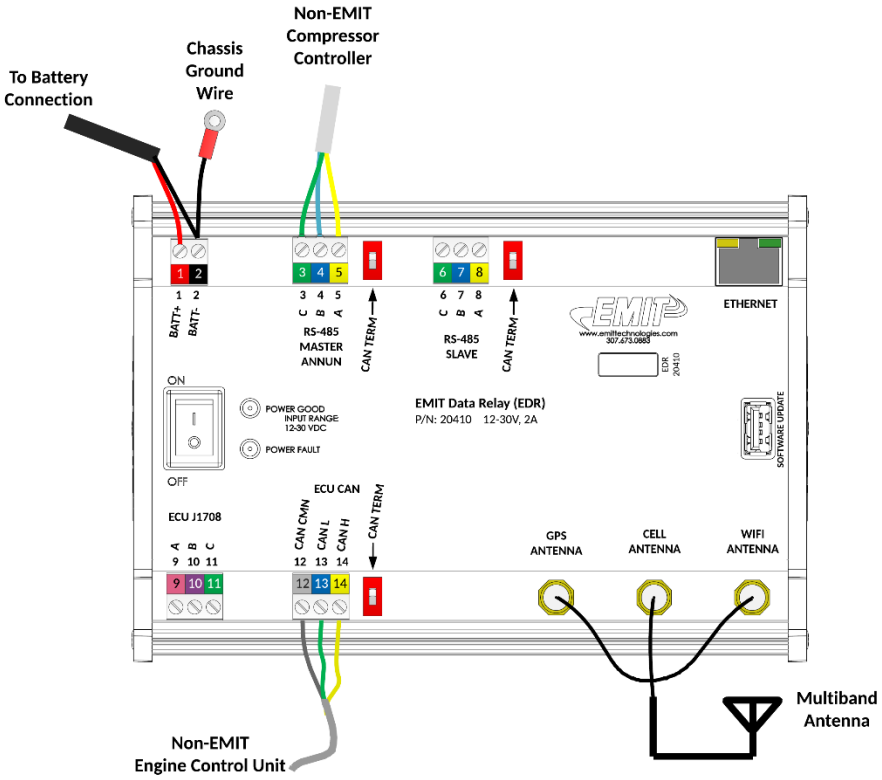
3 – MODBUS Master C (GND)
4 – MODBUS Master B (D+)
5 – MODBUS Master A (D-)

6 – MODBUS Slave C (GND)
7 – MODBUS Slave B (D+)
8 – MODBUS Slave A (D-)

BOTTOM TERMINAL CONNECTORS
9 – ECU J1708 A (D-)
10 – ECU J1708 B (D+)
11 – ECU J1708 C (GND)

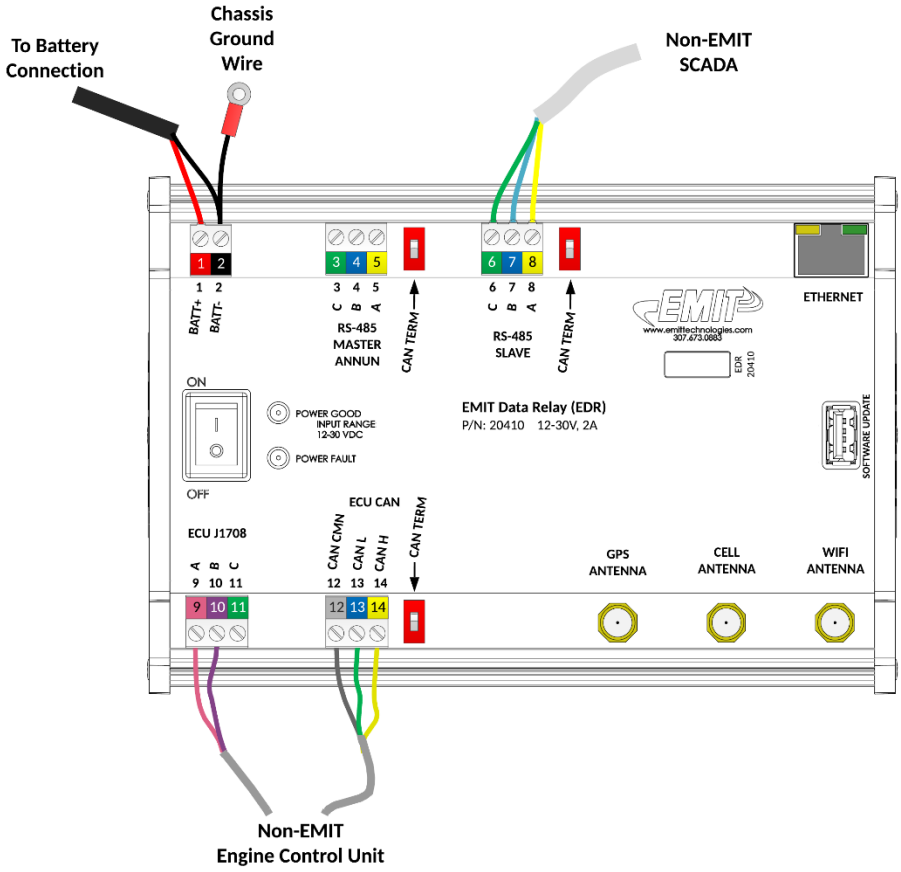
12 – ECU CAN CMN
13 – ECU CAN L
14 – ECU CAN H

Typical Example – SCADA



In a standard case where the system is collecting engine and compressor data and sending it to EMIT Data Services, the above connections will be used – 485 Master, Engine bus, and antenna. In some cases the ethernet may be used if the annunciator uses Modbus/TCP.

Other Example – Engine Data Translator



If another SCADA is present and the system is only being used for engine data translation, then the RS-485 slave (or ethernet) port and the ECU ports will be used.

ADEM ® WIRING

For an ADEM 4, run a cable from the “ECU CAN” port to the “CAN H/L/SHLD” of the ADEM control panel. Typically, the CANH is Yellow and the CANL is Green in the CAT panel. The terminal block number of the ADEM CAN wires vary by engine- see the engine schematic if unsure. Typically, an EMIT wire bundle for the panel will include wires that go from the appropriate terminal block that connects to ECU CAN to the ADEM CAN terminal block.

For an ADEM 3, there will be two connections required. Run the first connection from the “ECU CAN” port to the “CAN H/L/SHLD” of the ADEM control panel. Typically, the CANH is Yellow and the CANL is Green in the CAT panel. Run the second cable from the “ECU J1708” port to the “CDL+/-” connections in the ADEM panel. (Note: “A” connection on the EDR is CDL+ on the ADEM, and the “B” connection is CDL –). Typically, CDL+ is pink and CDL- is purple in the CAT panel. The

terminal block numbers in the CAT panel for the CAN and CDL wires vary by engine- see the engine schematic if unsure.

	ADEM 3	ADEM 4
“ECU CAN” 12,13,14	X	X
“ECU J1708” 9,10,11	X	

There is not any engine data translation setup other than to select that the system is an ADEM. The module will monitor both the CDL and CAN bus and collect any known values.

CAN Termination

For any CAN network, only the ends should be ‘terminated’ with a resistor. This ensures that data moves through the cable correctly. In most cases with the EDR, the CAN connection from the ADEM terminal blocks to the EDR creates a new end at the Data Relay. This means the ECU CAN switch should be terminated on the EDR (switched to the outside of the board) and the termination should be removed from the CAT panel. The termination in the CAT panel is usually a triangular plug cap at a Y junction of the CAN bus.



Figure 1. Example CAN termination (circled) can be removed when the switch on the EDR is terminated

Configuration

Operation as SCADA

To use the system in a SCADA scenario, where the Data Relay collects both engine and compressor data and sends it to EMIT's Data Services Cloud, the following areas need to be configured:

1. Modbus master table – defines source registers for compressor data such as suction pressure, discharge temperatures, etc.
2. Run status table- maps a register value to the run state (stopped, faulted, running)
3. Shutdown code table- maps a register value to a specific shutdown cause, e.g. "Low Suction Pressure".
4. Telematics service

Each of the three tables (#1-#3 above) can be configured using the downloaded table in Excel®, or directly on the Wi-Fi setup terminal. Each of these three areas will be covered in the next sections.

Modbus Master Data Table

In order to collect data from an annunciator or other panel system, a table must be defined that lists the Modbus location of various data items. This is accomplished with an excel sheet that has the following columns:

- **Data Name:** This column, which is not ever changed when editing the table, lists the EMIT tag name for each element. An example is "Engine_speed"
- **Target ID**: This column specifies the target Modbus ID of the slave device that will report the data value
- **Target Register**: This column specifies the target register that will be requested from the slave device to get this data item. The Data Relay will handle creating the Modbus request based on the register range, e.g. for a 4xxxx register the Modbus message type will be "Read holding register"
- **Offset, Scale**: These two columns specify how the value will be scaled from integer to float. Often, this will be simply 1 and 0 respectively to not scale the value. The value will be inserted into the table with this formula: [Sensor value] = [Register Value]*[Scale] + [Offset]
    - Example: A row specifies a scaling of 0.1 and an offset of -1000. The value "13178" is read from the Modbus register. This is stored as 13178*(0.1) + (-1000) = 317.8
- **Byte Format:** This column specifies the byte format of the register. Most will be 0 (unsigned 16 bit). Other options are:
    - 1 = Signed 16 bit
    - 2 = Unsigned 32 bit
    - 3 = Signed 32 bit
    - 4 = Unsigned 32-bit word swapped
    - 5 = Signed 32-bit word swapped

An example from the table is the following:

Data name	Target ID	Target Register	Offset	Scale	Byte format
Engine_speed	10	41002	0	1	0

Figure 2 - Modbus Table Row

In this example, when the Data Relay wants to collect the value for **engine speed**, it will request register **41002** from **ID 10** on the bus. The resulting value will be stored in the "Engine_speed" tag without scaling since the offset is 0 and the scale is 1.

For any data values that are not available on that unit, simply leave the register column blank or zero. Similarly, if the data value is expected over the engine data bus, leave that register column blank as well.

- Example A: On a Unit, the engine oil temperature is wired to the annunciator. The Modbus master table on the Data Relay will be filled in for the annunciator register that corresponds to engine oil temperature. The Data Relay will collect and store the oil temperature from the annunciator.
- Example B: On a different unit, the engine oil temperature is part of the engine controller and is not wired to any annunciator. On the Modbus master table, the register for engine oil temperature will be left blank. The Data Relay will **not** request the data value from the annunciator but **will** collect it on the engine data bus and fill in the same "engine oil temperature" tag all the same.

Run Status Table

The run status table specifies a target register and set of value that helps the Data Relay determine if the unit is running, stopped, or faulted. This information will be used to generate callouts when needed. This table is specified in an excel (csv) file.

The Run status table has these two global items:

- **State register:** A target register on the annunciator that can be used to determine the operating state
- **Slave ID:** The target Modbus ID for the annunciator

	In most cases, the Slave ID for every row will be the same since all the data is coming from one annunciator.

Next, the run status table lists possible register values with these two columns:

- **Register Value:** Some register value or range of values
- **State type:** A number representing the run state when the 'State Register' is reporting this value or within this range of values. Valid options are 1 = faulted, 2 = running, 3 = in between, 4 = manual stop

Example:

State register:	41001
Slave ID:	10
Register value or range of values	State type: 1= faulted, 2 = running, 3 = in between, 4 manual stop
0	4
1	4
2	3
3	1
4	2
5	2

Figure 3 - Run Status Table

In this example, the Data Relay will constantly read ID 10 Register 41001 to find out the run state. If this register returns a '5', the state is considered 'Running', since the row with '5' specifies a state type of '2', which is Running.

The "In between" state is for annunciator states that are not necessarily running or faulted, but instead are temporary transitions. The "In between" type state can be used to clean up state transitions. As an example, the 'Pre lube' state might be set as "in between". When the system goes from Stopped -> Pre-Lube -> Running, the data relay will consider one state transition (stopped to running) since the "in between" state of pre lube is ignored.

Shutdown Codes Table

Like the run status table, the Shutdown Code Table tells the Data Relay what type of shutdown has occurred when a register reads a particular value. At the top of the file, these global options are specified:

- **Code Register:** A register that can be read on the annunciator to tell the Data Relay what shutdown has occurred
- **Slave ID:** The target Modbus ID of the annunciator

Note: It is ok to use the same register for the code register and the state register from earlier, if the annunciator has a single register that can specify the run state and the fault code.

Below this, a table of Register value to description pairs are present. Each row specifies one register value and one description that will match that value.

Example:

Register va	Description
300	Low TC-1:DISCHG 1 TEMP
301	Low TC-2:DISCHG 2 TEMP
302	Low TC-3:
303	Low TC-4:
304	Low TC-5:COMP. OIL TEMP

Figure 4 - Shutdown Codes Table

(table continues)

The logic for sending callouts is:

1. While reading the run status register, the value transitions to a state that is categorized as “Faulted” in the run status table
2. After a short delay, the Data Relay reads the Fault Code Register
3. Using the fault code table, the Data Relay translates the Fault Code to a sensor string, e.g. “Low TC-1: DISCHG 1 TEMP”
4. The cause string is sent to the callout target(s)

Telematics Setup

The setup of telematics is done through the EMIT Data portal. The only user related setups are:

- Service activation: Done once by calling EMIT or emailing telematics@emittechnolgies.com while the unit is powered up
- Callout targets: Entered through the portal at https://data.emittechnologies.com/

In the portal, target users can be linked to a Data Relay to receive callouts. Optionally, callout schedules can be created. For more information, see the EMIT Data Portal documentation.

Module Slave Port

The Data Relay module has a RS-485 slave port on pins 6,7,8 that optionally can be used for one or both of these functions:

1. Relay modbus requests from another SCADA system to the annunciator (pass through)
2. Return data collected by the EDR itself

The setup of the Modbus Slave port, which is detailed in a later section, sets up the baud rate and module slave ID. Any requests the modbus slave port on the **EDR slave ID** will cause the data relay to return data from the EDR modbus table. Any requests to the **slave ID of the target annunciator** will be relayed out the modbus master port and valid data will be returned through the slave ID port.

Example

An existing SCADA is connected to a panel annunciator at slave ID 1. The EDR can be connected to the annunciator RS-485 port through pins 3,4,5 and the SCADA can be attached to port 6,7,8 of the EDR. The EDR will make requests through its master port to the annunciator, and additionally will pass through messages between the other SCADA and the annunciator. The setup of the other SCADA will not need to be changed, it will appear that it is talking to the annunciator directly.

Additionally, the EDR slave ID is set to 12. The existing SCADA can have some engine related registers added to pull engine data from the EDR at ID 12. When the SCADA asks for information at ID 1, the EDR relays the annunciator information. When the SCADA asks for information at ID 12, the EDR returns engine data.

The internal modbus registers can be found in the appendix.

Wi-Fi Console

A web portal is provided over Wi-Fi to the Data Relay for viewing current status and configuration on-site. This portal can be accessed with a cell phone, computer, or other web device.

Connecting

Check your target device's Wi-Fi settings for a network named ***EDR_xxxx***, where ***xxxx*** is the serial number of the Data Relay. Connect to this network and enter the password: ***emitemit***.

Note: There will be no internet access while you are connected to the network. It is recommended that you turn auto reconnect off.

Once connected, open a web browser and type http://172.16.16.1

Note: The Wi-Fi Console uses *HTTP* not *HTTPS*

This will bring up the EMIT Data Relay Wi-Fi console.

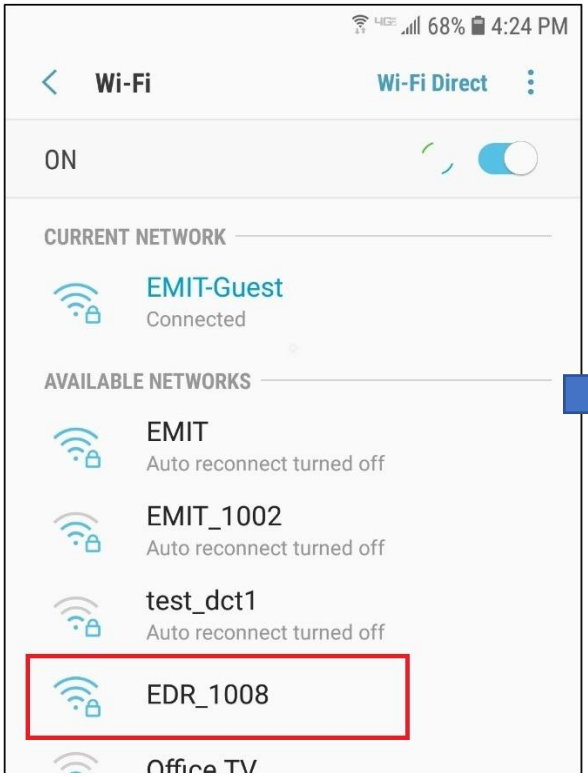


Figure 5 – Wi-Fi Selection

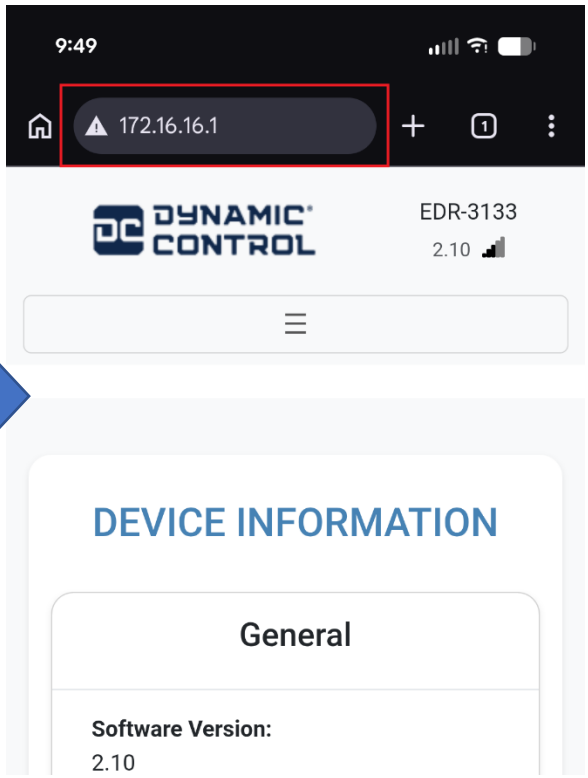


Figure 6 - URL Navigation

Wi-Fi Console Pages

From the top menu there will be the following page categories:

Overview

The Overview page has 3 sections; *Device Information*, *Data Source Information*, and *Data*.

The *Device Information* section lists the cellular and network statuses in addition to the device serial number, unit number, software version, and configured EMIT Telematics service level. If there is no signal strength or carrier shown in the Cellular section, check the antenna connections. In some cases, a higher antenna may be needed. The "Service Level" will show 2 or higher if the unit is activated to send remote data to EMIT. The activation is done by calling 307-673-0883 and asking for "Telematics Activation" or emailing telematics@emittechnologies.com with the board serial number, and the activation is sent over the air. The Unit Number is also pulled from the remote server and can be configured in the portal at https://data.emittechnologies.com/.

The *Data Source Information* section lists the statuses of the available data stream sources; Modbus and Engine Data Translator (EDT).

The table present in the *Data* section will show the latest values read from the annunciator, and when the value was last read. Normally values are polled every 10 seconds, but this may vary by software version.

The device can receive data from multiple sources. In the case that a data point is available from more than one source, the preferred source can be selected via the configuration gear icon next to each data point in the data table. If a data point is unavailable from a preferred source, the device will automatically select the next best available data source for that data point – if any are available. In most cases, the data source preference can be left in the default, automatic configuration.

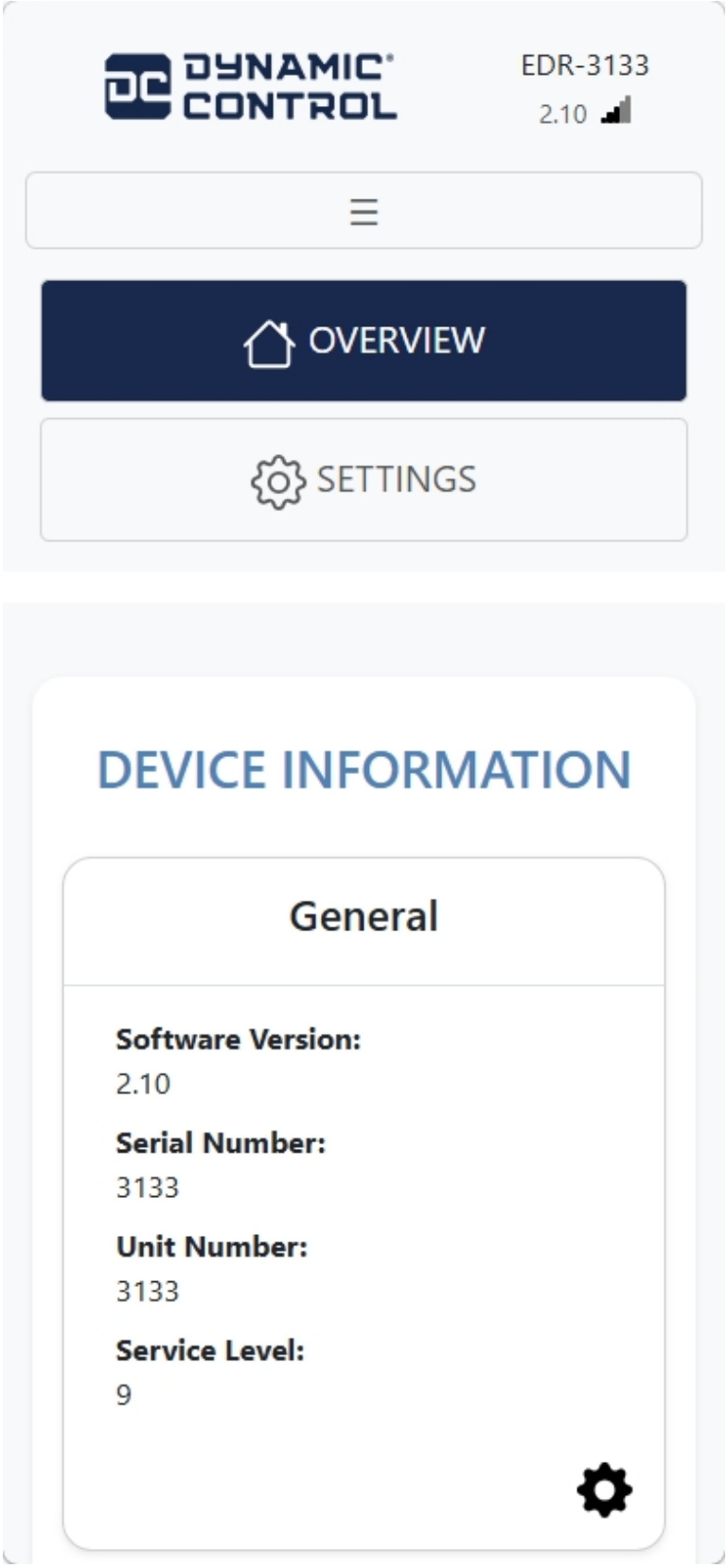


Figure 7 - Overview Page, Device Information, General

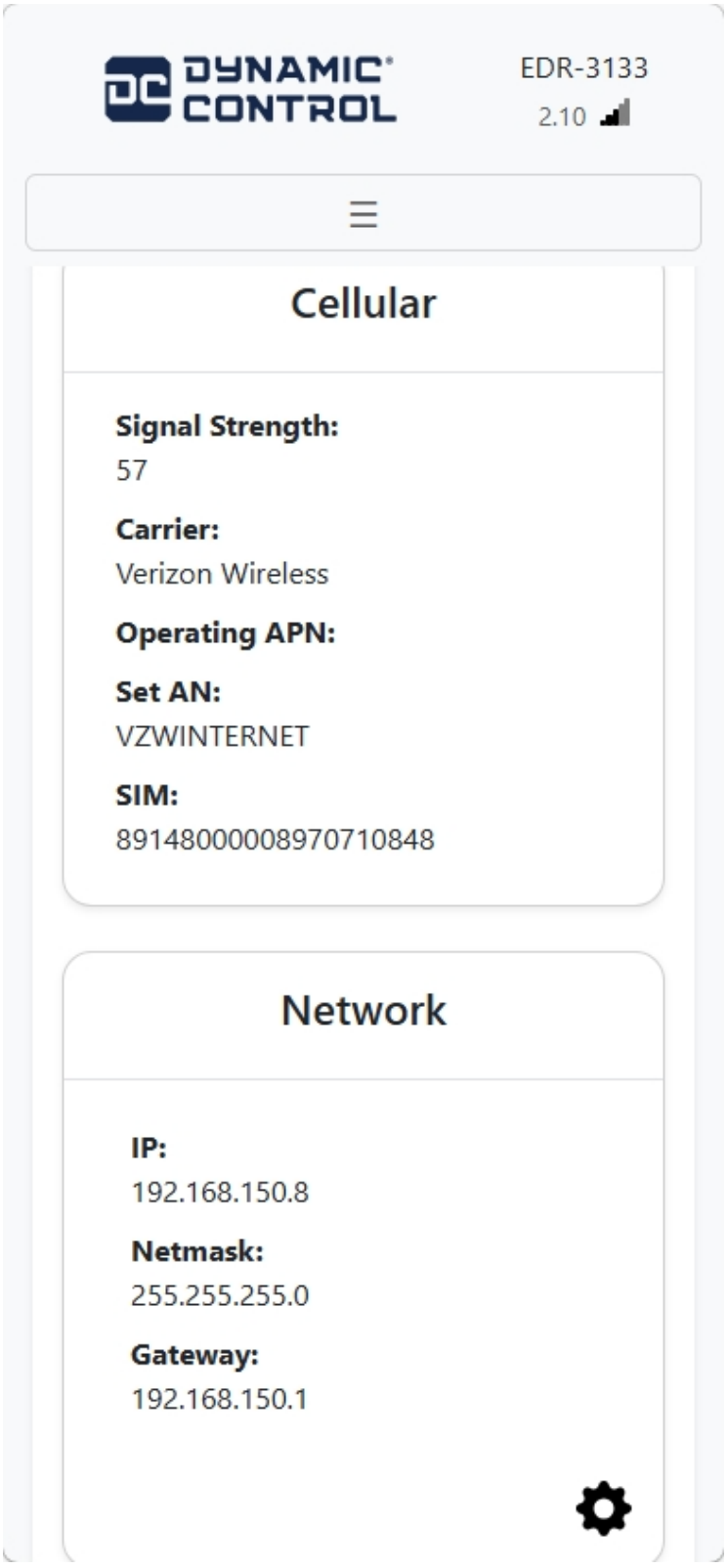


Figure 8 - Overview, Device Information, Cellular & Network

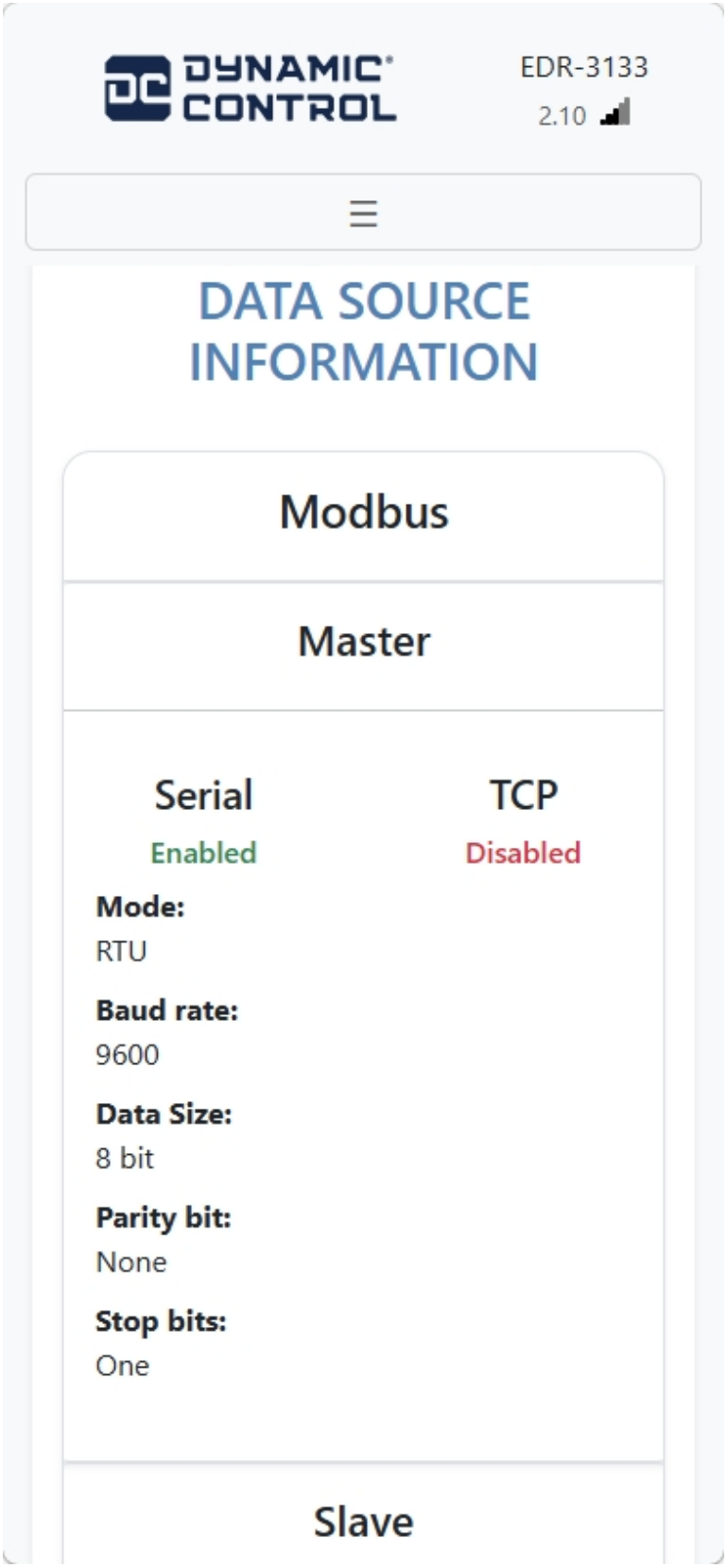


Figure 9 – Overview, Data Source Information, Modbus Master

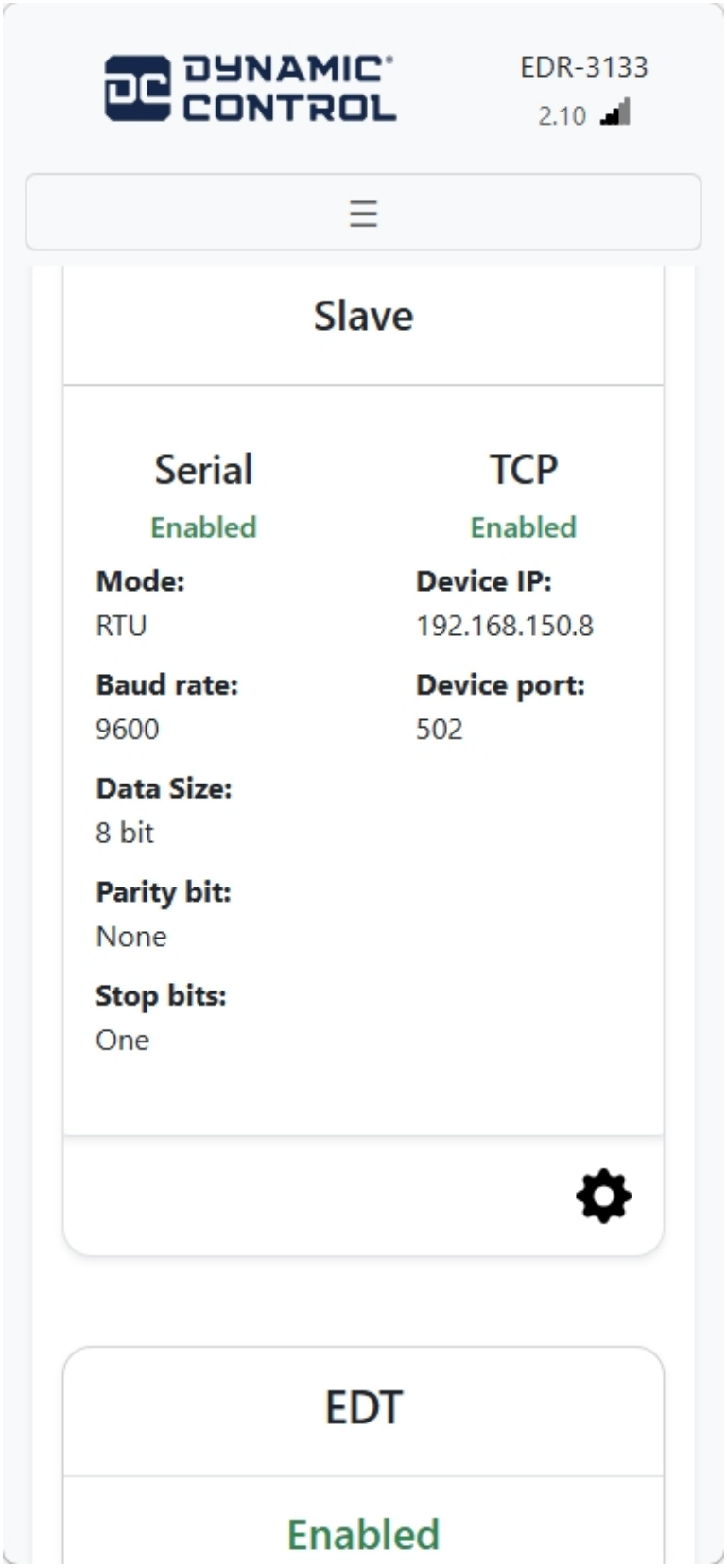


Figure 10 – Overview, Data Source Information, Modbus Slave

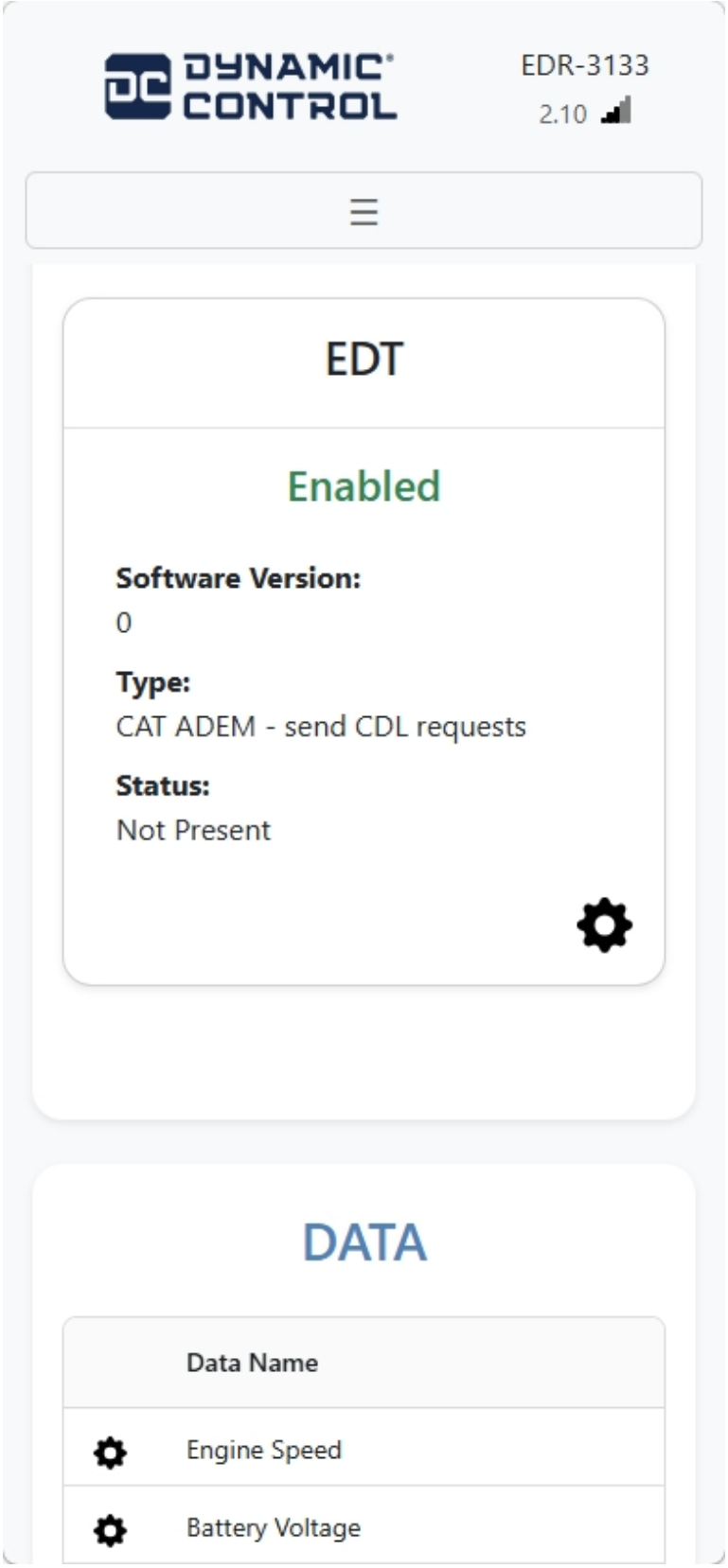


Figure 11 - Overview, Data Source Information, EDT

DYNAMIC CONTROL EDR-3133 2.10

OVERVIEW SETTINGS

DATA

Data Name	Value	Age	Source
Engine Speed	0	13s	Modbus
Battery Voltage	1	13s	Modbus
Manifold Pressure Left Absolu...	2	13s	Modbus
Manifold Pressure Right Abso...	3	13s	Modbus
Manifold Pressure Left PSIG	4	13s	Modbus
Manifold Pressure Right PSIG	5	13s	Modbus
Engine Oil Pressure PSIG	6	13s	Modbus
Current Ignition Timing	7	13s	Modbus
Throttle Position	8	13s	Modbus
Engine Oil Temperature	9	13s	Modbus
Precatalyst Temperature	10	13s	Modbus
Postcatalyst Temperature	11	13s	Modbus
Engine Hours	12	13s	Modbus
First Engine DTC	20	13s	Modbus
Engine % Load	21	13s	Modbus
Engine Jacket Water Temp	22	13s	Modbus
Intake Air Temp	23	13s	Modbus
Desired RPM	25	13s	Modbus
Aux Water Temp	27	13s	Modbus
Suction Pressure	30	13s	Modbus
Compressor Oil Pressure	32	13s	Modbus
Discharge Cyl 1 Temperature	33	13s	Modbus
Discharge Cyl 2 Temperature	34	13s	Modbus
Discharge Cyl 3 Temperature	35	13s	Modbus
Discharge Cyl 4 Temperature	36	13s	Modbus
Compressor Oil Temperature	37	13s	Modbus

Figure 12 - Overview, Data

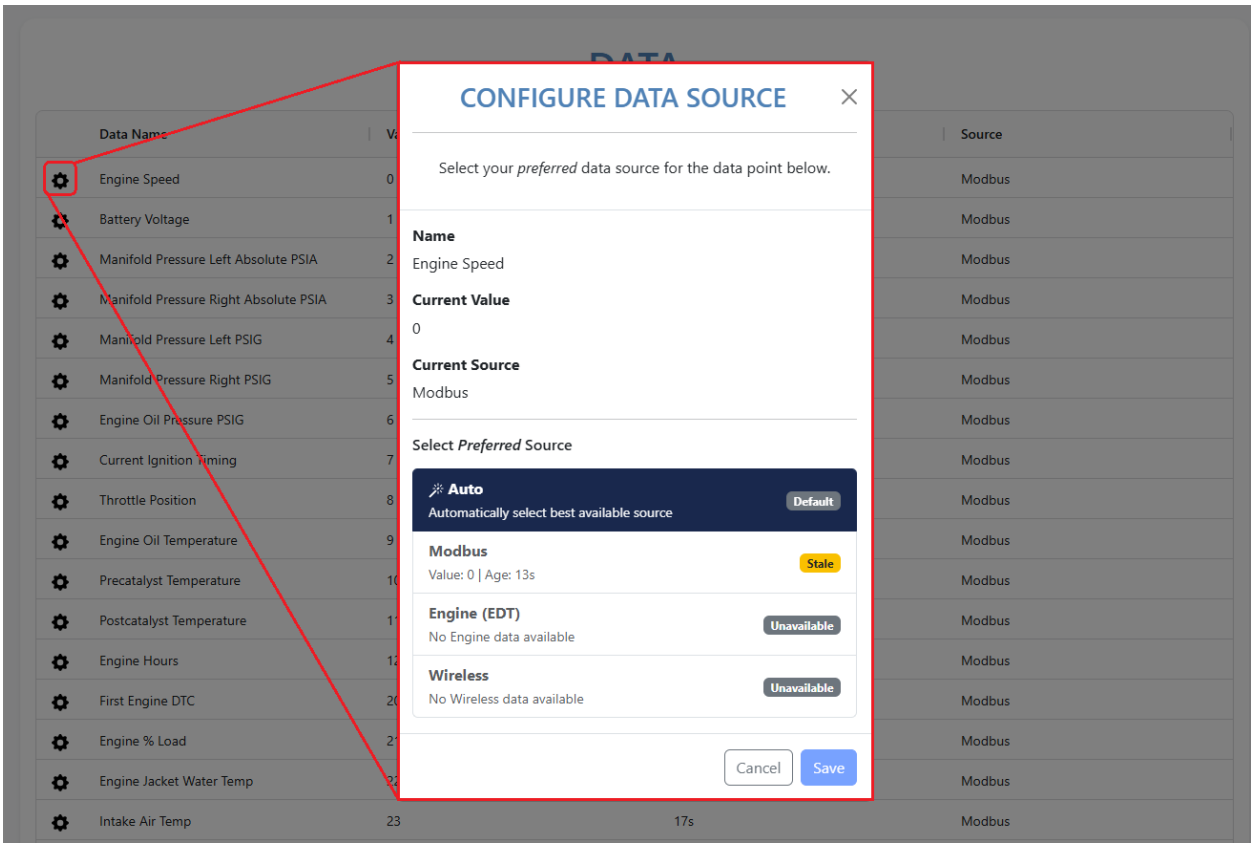


Figure 13 - Overview, Data, Configure Data Source

Settings

The Settings page is used for viewing and changing device configurations. Sections are:

Miscellaneous

Debug

The *Debug* section has buttons to interact with the device for various troubleshooting scenarios. The current EMIT Telematics service level is also reflected here.

The “Sync Telematics Config” button is not often used but may be requested by EMIT Tech support. The button will ping the server for the latest service level and Unit.

The “Send Test Callout” button can be used to send a test callout to the current callout targets for the unit.

	Even if the ‘send test callout’ works, the callouts will not send on a real shutdown if the service level is not 2 or higher.

Quick Config

The *Quick Config* section enables quick default device configuration for some commonly encountered Annunciator types.

Update Software

The *Update Software* section allows the deployment of different software versions. Select “Browse” to select a file, then “Update” to start an update. The update process will take about a minute. Software updates will have a file name “EDR_update[...].emt” where the [...] varies.

Device Logs

The *Device Logs* section allows a user to download log files for troubleshooting scenarios.

Timeout Alarm

The *Timeout Alarm* section allows the configuration of a timeout alarm.

Upload Configuration Files

The *Upload Configuration Files* section allows a user to upload configuration files.

Backup Existing Files

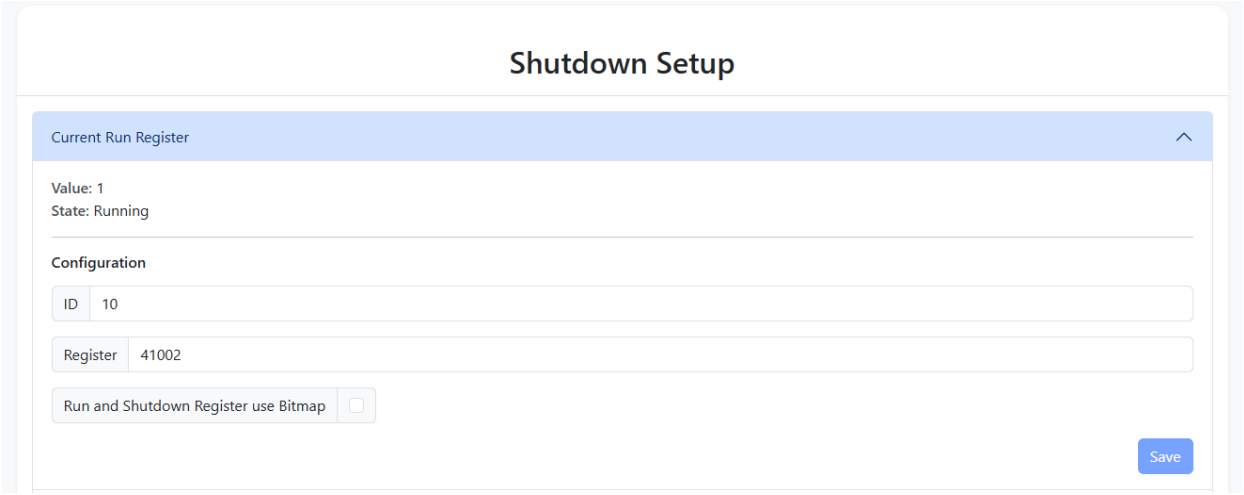
The *Backcup Existing Files* section allows a user to download configuration files.

Shutdown Setup

The Shutdown Setup section shows configuration and information related to the run and fault status. The page has five sections, detailed below.

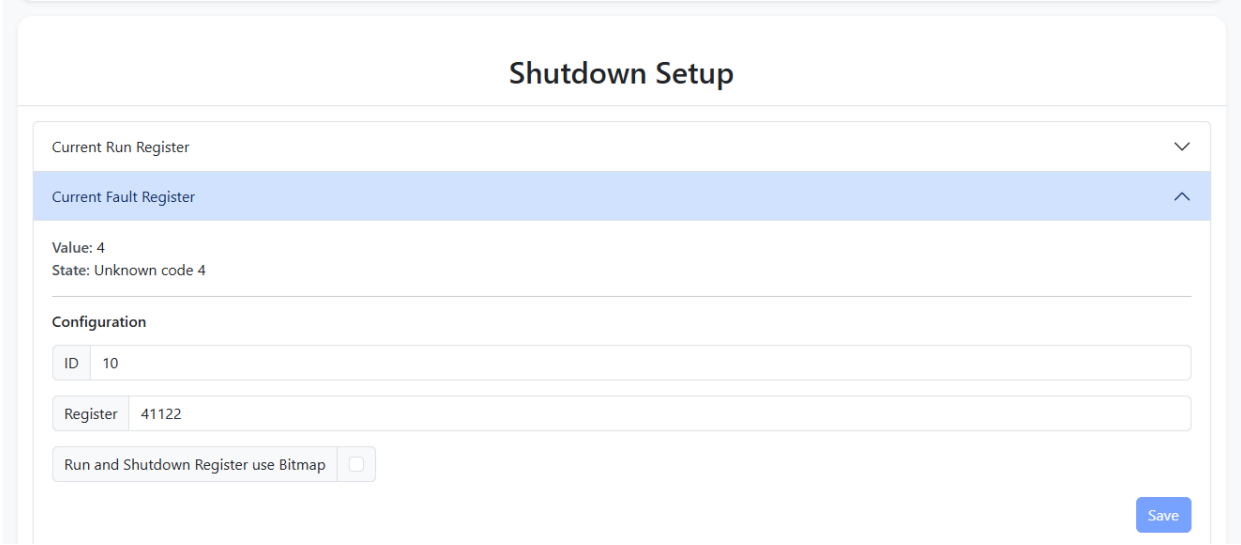
Current Run Register

The *Current Run Register* section allows configuration of a targeted register and ID that the device uses to determine the current run status. Normally this should be set up only once. The section also shows the current reading from that register and how it is decoded using the *Run Status Table*.



Current Fault Register

Like the *Current Run Register*, the *Current Fault Register* section will show the latest reading from the fault register and how it is interpreted.

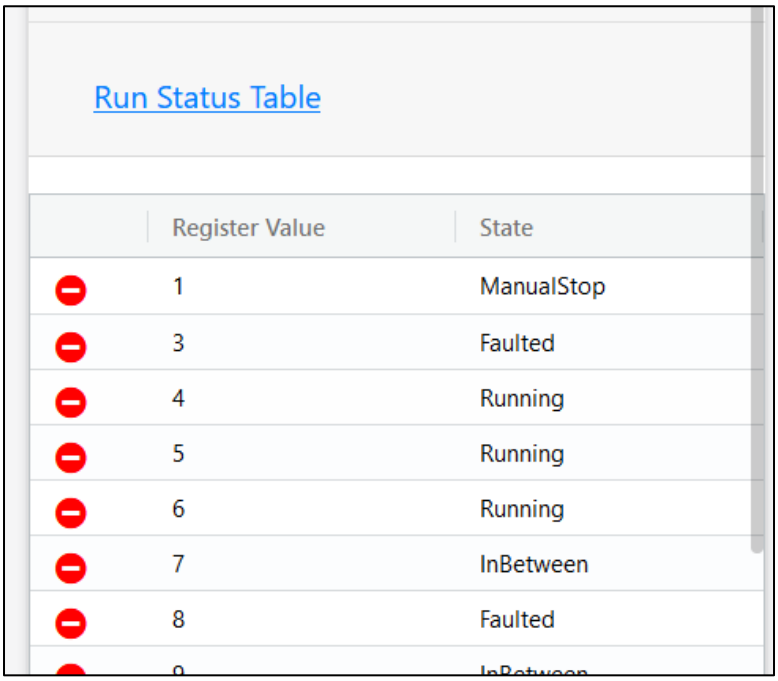


In some cases, the fault code register might not have a valid value if the unit is not actually faulted.

The current ID / Register being polled for the fault status can also be edited here if needed.

Run Status Table

The *Run Status Table* section shows the entire run status table configured. The value/ state type pairs can be adjusted here if needed.

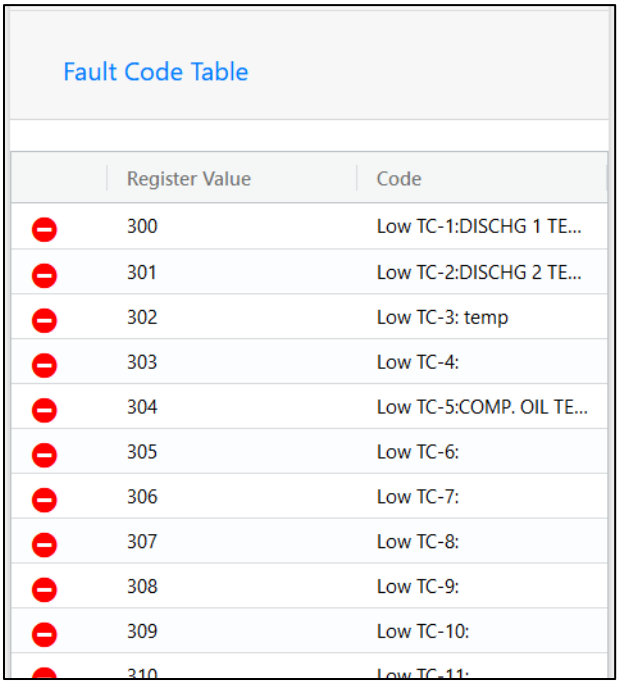


Run Status Table

Register Value	State
1	ManualStop
3	Faulted
4	Running
5	Running
6	Running
7	InBetween
8	Faulted

Fault Code Table

Under the *Fault Code Table* section, the entire fault code table is shown. The table can be edited or expanded here if needed.



Fault Code Table

Register Value	Code
300	Low TC-1:DISCHG 1 TE...
301	Low TC-2:DISCHG 2 TE...
302	Low TC-3: temp
303	Low TC-4:
304	Low TC-5:COMP. OIL TE...
305	Low TC-6:
306	Low TC-7:
307	Low TC-8:
308	Low TC-9:
309	Low TC-10:

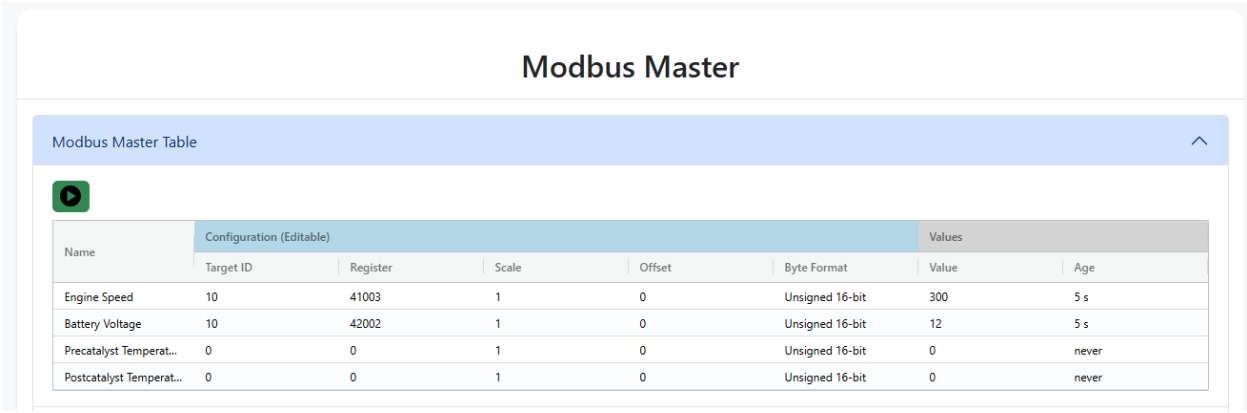
Table Configuration Files

Under this section, the fault code table or the run status table uploaded to the computer for editing in Excel ®. This is often the fastest way to set up the tables on initial setup.

Modbus Master

Modbus Master Table

The *Modbus Master Table* section shows the full master table and raw values read.



In the above screenshot, Engine speed is being pulled from Register 41003, ID 10. The value is being read as “300” successfully, because the age is 5s.

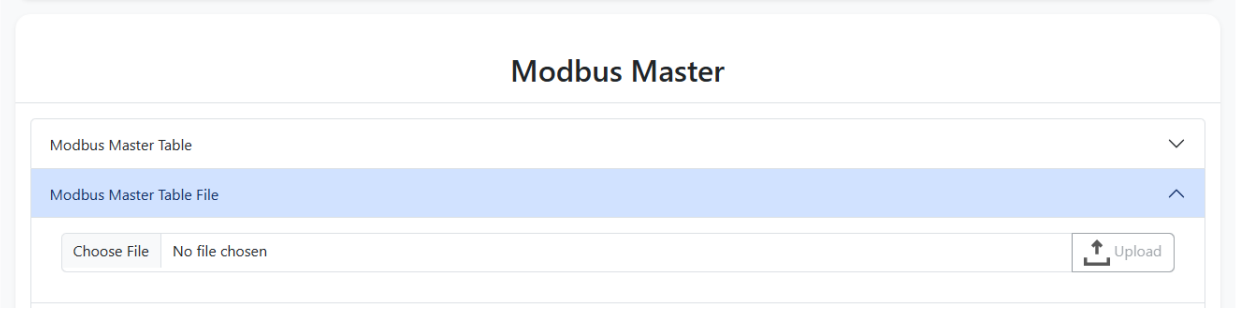
Some values will have a ‘never’ value in the Age column because they have not yet been successfully read. In some cases, the value is never even expected because the register is “0”. For example, “Manifold Pressure Right” on a single bank unit will never be seen. If an expected value is missing, it can be debugged from this table.

The table can be edited on this page by selecting a cell and changing the value.

	If editing the table on the Wi-Fi page, it will be easier to use a computer than a phone because of the screen size.

Modbus Master Table File

This section allows downloading of the full modbus master table. Uploading can be performed under section *Miscellaneous*, subsection *Backup Existing Files*.



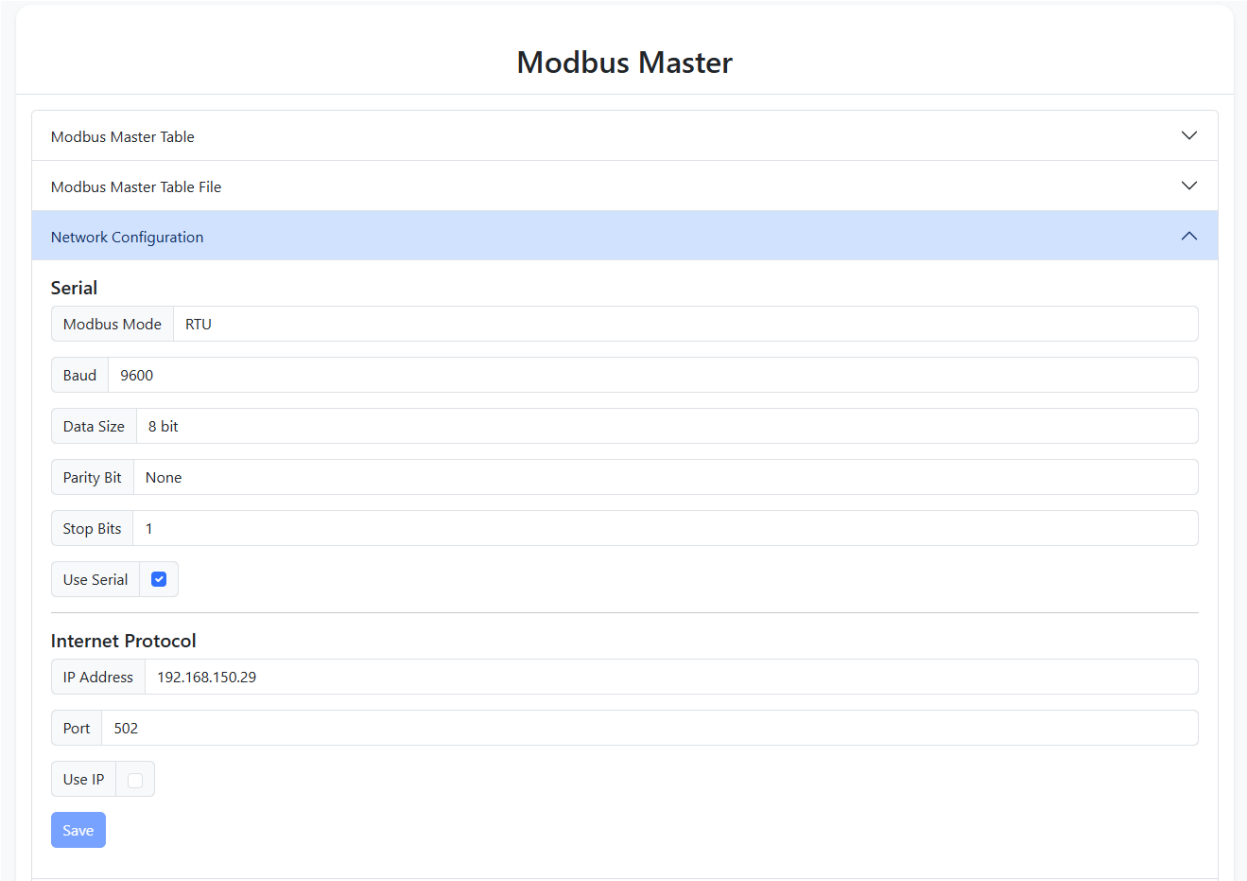
On initial setup, it may be easier to edit the file to get all the registers entered at once rather than edit each row individually over the Wi-Fi console. The download/upload functionality can be used to quickly configure devices.

To upload a new file, select “Browse” then “Upload”.

	Keep in mind that there are three table files – the Modbus master table for most data used here, and the run codes and fault codes table used later.

Network Configuration

The network configuration section is used to set up the RS-485 or Ethernet settings to connect to the slave device(s). Select either Serial or Ethernet by selecting a checkbox, then enter the information to match the settings for the device being targeted.



Network Statistics

The network statistics section shows the number of bytes sent and received. This may be useful for debugging.

Recent Messages

This heading shows the latest message sent and received over RS-485. This may be useful for debugging.

Port Timings

This heading allows configuration of the request interval when the device is configured to act as a Modbus Master. Read and write delays can be configured as necessary as well.

Modbus Slave

The Modbus Slave tab is used to set up the slave connection of the Data Relay. This is only used if another SCADA needs to pull engine data over Modbus from the Data Relay. This tab has three sections.

Network Configuration

The Network Configuration section is used to configure the serial or IP settings. The Modbus Slave ID of the device itself can also be set here.

Network Statistics

This section shows the bytes sent and received by the RS-485 slave port. This information may be useful for debugging.

Modbus Table

This section has a link to download the Modbus slave table. This table is the same for all devices.

Engine Data Translator

The Engine Data Translator tab has two sections related to the engine data.

Engine Data

This section will show all currently collected engine data. Any valid information seen on the engine data bus will show up here.

Configuration

Under this section, the engine type can be selected.

Internal Modbus Table

Optionally, the module RS-485 slave port can be used to return collected data to another SCADA system. The slave ID will be set in the Modbus Slave setup portion of the Wi-Fi console.

All potential data is shown in this table, but many values will not be found on some engines. Any non-relevant or not found value will return -1 (65,535) in the register. The currently expected data can be verified on the first page of the wifi console.

Standard accumulated data

Values in each register can come from Modbus OR the engine data translator. If both sources have valid data, the Modbus value will have priority.

Holding Register	Description	Unit	Value could come from Modbus	Value could come from Engine	Min SW
42000	Engine Speed	RPM	X	X	1.36
42001	Battery Voltage	V	X	X	1.36
42002	Intake Manifold Pressure Left Absolute	PSIA		X	1.95
42003	Intake Manifold Pressure Right Absolute	PSIA		X	1.95
42004	Intake Manifold Pressure Left	PSI Gauge	X	X	1.36
42005	Intake Manifold Pressure Right	PSI Gauge	X		1.36
42006	Engine Oil Pressure	PSI Gauge	X	X	1.36
42007	Current Ignition Timing	Deg		X	1.36
42008	Current throttle position	Pct		X	1.36
42009	Engine Oil Temp	F	X	X	1.36
42010	Precat Temp	F	X	X	1.36
42011	Postcat Temp	F	X	X	1.36
42012	Engine Hours Low		X	X	1.36
42013	Engine Hours High		X	X	1.36
42014-19	RESERVED	--	--	--	--
42020	EDT First DTC			X	1.36
42021	Engine Pct Load	Pct		X	1.36
42022	Jacket Water Temp	F	X	X	1.36
42023	Intake Air Temperature	F	X	X	1.36
42024	Oil to Coolant Diff Temp	F		X	1.69
42025	Desired RPM	RPM	X	X	1.69
42026	Fuel Gas Correction Factor			X	1.69
42027	Aux Water Temp	F	X		1.69
42028	Engine oil differential pressure	PSI		X	1.86
42029	RESERVED	--	--	--	--
42030	Suction Pressure	**	X		1.36
42031	RESERVED	--	--	--	--
42032	Compressor Oil Pressure	**	X		1.36
42033	Discharge 1 Temp	F	X		1.36
42034	Discharge 2 Temp	F	X		1.36
42035	Discharge 3 Temp	F	X		1.36

42036	Discharge 4 Temp	F	X		1.36
42037	Compressor Oil Temp	F	X		1.36
42038	Discharge 1 Pressure	**	X		1.36
42039	Discharge 2 Pressure	**	X		1.36
42040	Discharge 3 Pressure	**	X		1.36
42041	Annunciator Run Status		X		1.36
42042	Brain Run/Shutdown code		X		1.36
42043	Signal Strength (From EDR cell)	Pct	--	--	1.36
42044	Suction Temperature	C/F*	X		1.36
42046	Fuel Pressure	**	X	X	1.69
42047	EDR Ambient Temp	F			1.69
42048	Discharge 4 Pressure	**	X		1.69
42049	Discharge Cyl 1B Temp	**	X		1.69
42050	Discharge Cyl 3B Temp	**	X		1.69
42051	Discharge Cyl 5 Temp	**	X		1.88
42052	Discharge Cyl 6 Temp	**	X		1.88
42060	Package Hours		X		1.86
42070	Throw 1 Tension	**	X		1.69
42071	Throw 1 Compression	**	X		1.69
42072	Throw 2 Tension	**	X		1.69
42073	Throw 2 Compression	**	X		1.69
42074	Throw 3 Tension	**	X		1.69
42075	Throw 3 Compression	**	X		1.69
42076	Throw 4 Tension	**	X		1.69
42077	Throw 4 Compression	**	X		1.69
42078	Throw 5 Tension	**	X		1.69
42079	Throw 5 Compression	**	X		1.69
42080	Throw 6 Tension	**	X		1.69
42081	Throw 6 Compression	**	X		1.69
42082	Left Turbo In	F	X	X	1.69
42083	Left Turbo Out	F	X	X	1.69
42084	Right Turbo In	F	X	X	1.69
42085	Right Turbo Out	F	X	X	1.69
42086	Engine Cyl 1 Exhaust Temp	F	X	X	1.69
42087	Engine Cyl 2 Exhaust Temp	F	X	X	1.69
42088	Engine Cyl 3 Exhaust Temp	F	X	X	1.69
42089	Engine Cyl 4 Exhaust Temp	F	X	X	1.69
42090	Engine Cyl 5 Exhaust Temp	F	X	X	1.69
42091	Engine Cyl 6 Exhaust Temp	F	X	X	1.69
42092	Engine Cyl 7 Exhaust Temp	F	X	X	1.69
42093	Engine Cyl 8 Exhaust Temp	F	X	X	1.69

42094	Engine Cyl 9 Exhaust Temp	F	X	X	1.69
42095	Engine Cyl 10 Exhaust Temp	F	X	X	1.69
42096	Engine Cyl 11 Exhaust Temp	F	X	X	1.69
42097	Engine Cyl 12 Exhaust Temp	F	X	X	1.69
42098	Engine Cyl 13 Exhaust Temp	F	X	X	1.69
42099	Engine Cyl 14 Exhaust Temp	F	X	X	1.69
42100	Engine Cyl 15 Exhaust Temp	F	X	X	1.69
42101	Engine Cyl 16 Exhaust Temp	F	X	X	1.69
42102	Gas After IC 1	**	X		1.69
42103	Gas After IC 2	**	X		1.69
42104	Gas After AC	**	X		1.69
42105	Cooler Vibration 1	**	X		1.69
42106	Compressor Vibration 1	**	X		1.69
42107	Engine Vibration 1	**	X		1.69
42108	Cooler Vibration 2	**	X		1.69
42109	Cooler Vibration 3	**	X		1.69
42110	Compressor Vibration 2	**	X		1.69
42111	Engine Vibration 2	**	X		1.69
42112	Upstream Suction	**	X		1.69
42113	Noflow Left Seconds	**	X		1.69
42114	Noflow Right Seconds	**	X		1.69
42115	Main Bearing Temp 1	**	X		1.69
42116	Main Bearing Temp 2	**	X		1.69
42117	Main Bearing Temp 3	**	X		1.69
42118	Main Bearing Temp 4	**	X		1.69
42119	Main Bearing Temp 5	**	X		1.69
42120	Main Bearing Temp 6	**	X		1.69
42121	Catalyst Differential Pressure	**	X		1.86
42150	Motor DE temp	**	X		1.86
42151	Motor NDE temp	**	X		1.86
42152	Motor voltage A-B	**	X		1.86
42153	Motor voltage B-C	**	X		1.86
42154	Motor voltage C-A	**	X		1.86
42155	Motor current A	**	X		1.86
42156	Motor current B	**	X		1.86
42157	Motor current C	**	X		1.86
42158	Motor vibration DE	**	X		1.86
42159	Motor vibration NDE	**	X		1.86
42160	Motor run hours	**	X		1.86
42162	Motor RTD1	**	X		1.86
42163	Motor RTD2	**	X		1.86

42164	Motor RTD3	**	X		1.86
42165	Motor RTD4	**	X		1.86
42166	Motor RTD5	**	X		1.86
42167	Motor RTD6	**	X		1.86
42169	Motor load pct	**	X		1.86
42170	Motor power factor	**	X		1.86
42171	Motor total power	**	X		1.86
42172	Motor average phase current	**	X		1.86
42174	Motor power	**	X		1.86
42190	Dual drive in electric mode	**	X		1.86

**The scale of the annunciator pressure values will depend on how the master data table is set up. In most cases this should match the panel.

Engine Data Translator Registers

Other engine items will be placed into this list.

*This column was added v1.81

**The unit column shows the raw engine unit from the metric column. For the 47xxx registers, the metric units will be translated to US (e.g. C to F) and some units will be left the same (e.g. RPM)

Holding Register (Metric)	Holding Register (US Units)*	Description	Unit**	Min SW
44001	47000	Engine speed	RPM	1.00
44002	47001	Battery voltage	V	1.00
44003	47002	Intake manifold 1 absolute pressure	KpaA	1.00
44005	47004	Engine oil pressure	KpaG	1.00
44006	47005	Engine actual timing	Deg	1.00
44007	47006	Desired speed	RPM	1.00
44008	47007	Engine oil temp	C	1.00
44009	47008	Engine coolant temp	C	1.00
44010	47009	Precat Temp	C	1.00
44011	47010	Postcat Temp	C	1.00
44012	47011	Diff CAT Temp	C	1.00
44013	47012	Engine hours low		1.00
44014	47013	Engine hours high		1.00
44015	47014	Fuel Temperature	C	1.19
44016	47015	Fuel specific gravity * 1000		1.19
44017	47016	Desired Timing 1	Deg	1.19
44018	47017	Desired Timing 2	Deg	1.80
44025	47024	WKI Value		1.00
44026	47025	Throttle valve 1 position	Pct	1.00
44027	47026	Intake manifold 1 absolute pressure high resolution	KpaA	1.00
44028	47027	Intake manifold 2 absolute pressure high resolution	KpaA	1.00
44029	47028	Exhaust manifold L temp (Waukesha)	C	1.00
44030	47029	Exhaust manifold R temp (Waukesha)	C	1.00
44031	47030	Air intake temp	C	1.00
44032	47031	Ambient air temp	C	1.00
44033	47032	Ignition Timing Cyl 1	Deg	1.00
44034	47033	Ignition Timing Cyl 2	Deg	1.00
44035	47034	Ignition Timing Cyl 3	Deg	1.00
44036	47035	Ignition Timing Cyl 4	Deg	1.00

44037	47036	Ignition Timing Cyl 5	Deg	1.00
44038	47037	Ignition Timing Cyl 6	Deg	1.00
44039	47038	Ignition Timing Cyl 7	Deg	1.00
44040	47039	Ignition Timing Cyl 8	Deg	1.00
44041	47040	Ignition Timing Cyl 9	Deg	1.00
44042	47041	Ignition Timing Cyl 10	Deg	1.00
44043	47042	Ignition Timing Cyl 11	Deg	1.00
44044	47043	Ignition Timing Cyl 12	Deg	1.00
		Note: For ignition timing cyls 13-20 see 44384 below		
44100	47099	Fuel valve one intake absolute pressure	Kpa	1.00
44101	47100	Fuel valve differential pressure	Kpa	1.00
44102	47101	Unfiltered oil pressure	Kpa	1.00
44103	47102	Turbocharger 1 inlet temp	C	1.00
44104	47103	Turbocharger 1 outlet temp	C	1.00
44105	47104	Turbocharger 2 inlet temp	C	1.00
44106	47105	Turbocharger 2 outlet temp	C	1.00
44107	47106	Engine exhaust port temp 1	C	1.00
44108	47107	Engine exhaust port temp 2	C	1.00
44109	47108	Engine exhaust port temp 3	C	1.00
44110	47109	Engine exhaust port temp 4	C	1.00
44111	47110	Engine exhaust port temp 5	C	1.00
44112	47111	Engine exhaust port temp 6	C	1.00
44113	47112	Engine exhaust port temp 7	C	1.00
44114	47113	Engine exhaust port temp 8	C	1.00
44115	47114	Engine exhaust port temp 9	C	1.00
44116	47115	Engine exhaust port temp 10	C	1.00
44117	47116	Engine exhaust port temp 11	C	1.00
44118	47117	Engine exhaust port temp 12	C	1.00
44119	47118	Engine exhaust port temp 13	C	1.00
44120	47119	Engine exhaust port temp 14	C	1.00
44121	47120	Engine exhaust port temp 15	C	1.00
44122	47121	Engine exhaust port temp 16	C	1.00
44123	47122	Oil filter differential pressure	KPa	1.00
44124	47123	Engine coolant pressure	KPa	1.00
44125	47124	First DTC detected		1.00
44126	47125	Engine pct load at current speed	%	1.00
44127	47126	CDL Code at last shutdown*		1.19
44128	47127	Latest CDL Error code*		1.19
44129	47128	Exhaust current NOx	ppm	1.19
44130	47129	Fuel Correction Factor	%	1.80

44131	47130	Engine exhaust port temp 17	C	1.80
44132	47131	Engine exhaust port temp 18	C	1.80
44133	47132	Engine exhaust port temp 19	C	1.80
44134	47133	Engine exhaust port temp 20	C	1.80
44300	47299	Detonation Level (0-255)		1.72
44301	47300	Detonation level cyl 1		1.72
44302	47301	Detonation level cyl 2		1.72
44303	47302	Detonation level cyl 3		1.72
44304	47303	Detonation level cyl 4		1.72
44305	47304	Detonation level cyl 5		1.72
44306	47305	Detonation level cyl 6		1.72
44307	47306	Detonation level cyl 7		1.72
44308	47307	Detonation level cyl 8		1.72
44309	47308	Detonation level cyl 9		1.72
44310	47309	Detonation level cyl 10		1.72
44311	47310	Detonation level cyl 11		1.72
44312	47311	Detonation level cyl 12		1.72
44313	47312	Detonation level cyl 13		1.72
44314	47313	Detonation level cyl 14		1.72
44315	47314	Detonation level cyl 15		1.72
44316	47315	Detonation level cyl 16		1.72
		(Note: For detonation lvl cyls 17-20 see below at 44380)		
44317	47316	Actual Exhaust Oxygen	%	1.72
44318	47317	Desired Exhaust Oxygen	%	1.72
44319	47318	Actual AFR		1.72
44320	47319	Desired AFR		1.72
44321	47320	Desired Full Load Exhaust O2		1.72
44322	47321	Desired Nox	Ppm	1.72
44323	47322	Fuel Quality Setting		1.72
44324	47323	Engine Rated Speed		1.72
44325	47324	Cooldown Minutes Configuration		1.72
44326	47325	Low Idle Configuration		1.72
44327	47326	Max Hi Idle Configuration		1.72
44328	47327	Min Hi Idle Configuration		1.72
44329	47328	Fuel Position	%	1.72
44330	47329	Fuel Valve Position		1.72
44331	47330	Fuel Rate		1.72
44332	47331	Air to Fuel Diff Pressure	KPa	1.72
44333	47332	Gas Fuel Flow	SCFM	1.72
44334	47333	Fuel Actuator Command Position		1.72

44335	47334	Wastegate Command Position		1.72
44336	47335	Choke Command Position		1.72
44337	47336	Turbo Bypass Command		1.72
44338	47337	Throttle Actuator Command Position		1.72
44339	47338	Throttle Valve Differential Pressure	KPa	1.72
44340	47339	Jacket Water to Oil Temp Differential	C	1.72
44341	47340	Desired Combustion Time		1.72
44342	47341	Actual Air Pressure	KPa	1.72
44343	47342	Desired Manifold Air Intake Pressure	KPa	1.72
44344	47343	Intake Manifold Air Flow		1.72
44345	47344	Specific Heat Ratio		1.72
44346	47345	Transformer Volts Cyl 1	V	1.72
44347	47346	Transformer Volts Cyl 2	V	1.72
44348	47347	Transformer Volts Cyl 3	V	1.72
44349	47348	Transformer Volts Cyl 4	V	1.72
44350	47349	Transformer Volts Cyl 5	V	1.72
44351	47350	Transformer Volts Cyl 6	V	1.72
44352	47351	Transformer Volts Cyl 7	V	1.72
44353	47352	Transformer Volts Cyl 8	V	1.72
44354	47353	Transformer Volts Cyl 9	V	1.72
44355	47354	Transformer Volts Cyl 10	V	1.72
44356	47355	Transformer Volts Cyl 11	V	1.72
44357	47356	Transformer Volts Cyl 12	V	1.72
44358	47357	Transformer Volts Cyl 13	V	1.72
44359	47358	Transformer Volts Cyl 14	V	1.72
44360	47359	Transformer Volts Cyl 15	V	1.72
44361	47360	Transformer Volts Cyl 16	V	1.72
44362	47361	Transformer Volts Cyl 17	V	1.72
44363	47362	Transformer Volts Cyl 18	V	1.72
44364	47363	Transformer Volts Cyl 19	V	1.72
44365	47364	Transformer Volts Cyl 20	V	1.72
44370	47369	Mass fuel flow	Kg/Hr	1.72
44380	47379	Detonation level cyl 17		1.72
44381	47380	Detonation level cyl 18		1.72
44382	47381	Detonation level cyl 19		1.72
44383	47382	Detonation level cyl 20		1.72
44384	47383	Ignition Timing Cyl 13	Deg	1.72
44385	47384	Ignition Timing Cyl 14	Deg	1.72
44386	47385	Ignition Timing Cyl 15	Deg	1.72
44387	47386	Ignition Timing Cyl 16	Deg	1.72
44388	47387	Ignition Timing Cyl 17	Deg	1.72

44389	47388	Ignition Timing Cyl 18	Deg	1.72
44390	47389	Ignition Timing Cyl 19	Deg	1.72
44391	47390	Ignition Timing Cyl 20	Deg	1.72

*The most significant bit of the CDL code reading signifies if it is an E type code (e.g. E267(1)). If the bit is set, the code is E type. Otherwise it is a CID type code.

Note: For higher resolution data, each register can also be read as a function code 04 (e.g. 34001 instead of 44001 for engine speed), and will be scaled with an offset of -32768 and a resolution of 0.1/bit.

Further Information

For further information or technical support, contact EMIT at 307-673-0883 or visit www.emittechnologies.com