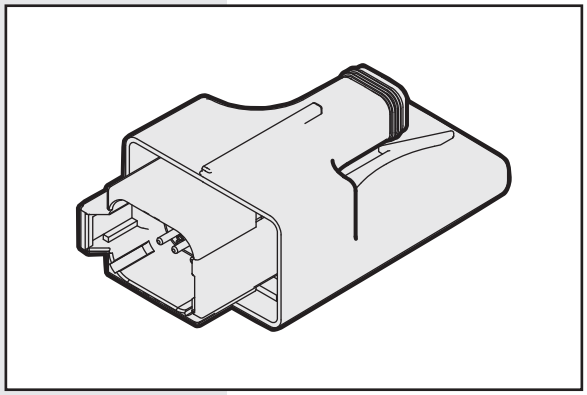
User Manual

ExDR-0201A

Valve Driver for Hydraulic Proportional Cartridge Valves



HydraForce

UM_ExDR-0201A • 7709110 • 05/17 •

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INTRODUCTION

Overview

This instruction details how to connect, program, and monitor the ExDR-0201A valve driver using a USB to CAN converter and a laptop computer.

Description

The ExDR-0201A is a CE-qualified, compact plug-in style, microprocessor-based valve driver designed for use in hydraulic proportional valve applications. It is configurable to drive either one or two coils simultaneously using SAE J1939 CAN input or an independent voltage, current, resistance, PWM, or frequency signal. The ExDR-0201A proportionally controls one or two coils to a user-defined metering profile. *HF-Impulse*, an easy-to-use configuration tool, is available as a free download at www.hydraforce.com/electronics.

Operation

The driver accepts inputs from commonly available analog or digital operator interface devices (joystick, potentiometer, sensors, etc.) as well as J1939 command messages. The input signal drives the output current to the user-defined ramp rate, enabling accurate and proportional metering control of the hydraulic valve. As the input changes, the output follows the metering profile, allowing optimum system response. You can configure the unit for direct valve operation.

Diagnostic Features

Built-in diagnostics detect user-defined signal aberrations. Signals below minimum or above maximum for a duration of 100 ms turn off the valve. The driver output drops and holds at the inactive stand-by condition. When the fault is corrected, the controller returns to standard operation.

Tools/Materials You Need

You supply:

- ❑ Computer
- ❑ Power supply, 9–32 Vdc

HydraForce supplies:

Software

Download from www.hydraforce.com/electronics. Click CoreTek ExDR-0201A

- ❑ *HF-Impulse*
- ❑ Drivers for USB to CAN converter
- ❑ ExDR-0201A firmware

Hardware

- ❑ ExDR-0201 start-up kit: 4210080
  - Harness: 4000304
  - USB to CAN converter: 4000371
  - ExDR-0201A: 4204700

Documents

- ❑ UM_ExDR-0201A User Manual (this document)
- ❑ TR_ExDR-0201A Technical Reference

CONNECTING

Getting Set Up

1. Download *HF-Impulse* from the HydraForce electronics portal at www.hydraforce.com/electronics. This software communicates via SAE J1939 CAN with the ExDR-0201A or other CoreTek™ machine controllers for programming and diagnostics.

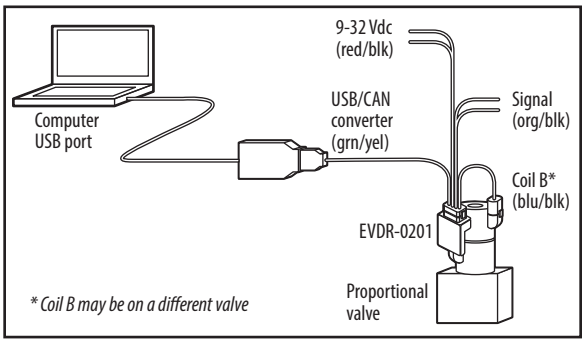
Note: www.hydraforce.com/electronics *is a secure portal. Register if you do not already have a user ID and password. Registration is handled automatically if you use a company e-mail address.*

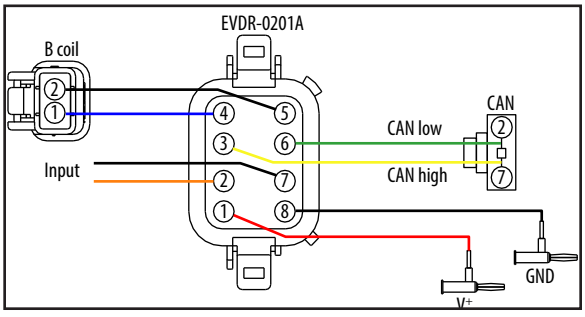
2. Unzip the file after downloading. Run *HfInpulse.Installer.msi* to install.
3. Download drivers for USB to CAN converter from the electronics portal. There are several device drivers available on the portal. Ensure you download the drivers for the device you have. Unzip the file after downloading. Locate and run the install file. Follow included instructions if you have any questions about the install process.
4. Connect the USB to CAN converter to your computer. Select **`Install the Software Automatically`** when prompted by the *Add New Hardware Wizard*. Follow the prompts. You may have to repeat this process if you connect the converter to another USB port on the same computer.

Making Connections

Make electrical connections.

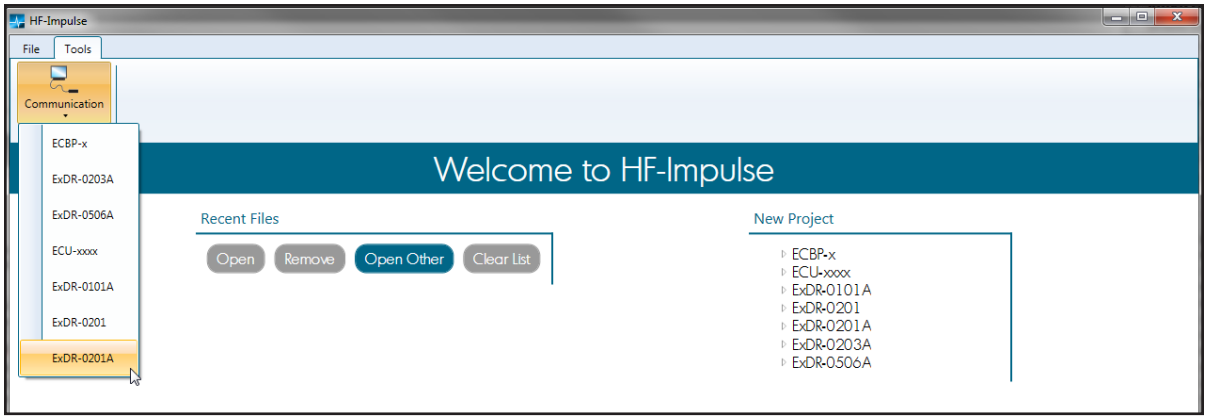
- Connect the harness to the ExDR-0201A.
- Connect the harness to 9–32 Vdc power supply.
- Connect the harness to the USB to CAN converter. Make sure the CAN network has one 120 ohm resistor. Test harnesses from HydraForce include this.
- Connect the converter to the appropriate USB port on your computer. This should be the same port used previously to set up the converter.





Establishing Communications

1. Start *HF-Impulse* software.



2. Select **`Communications|ExDR-0201A`** to establish a connection with the ExDR-0201A.
3. Choose the **`USB to CAN Adapter`** type you are using.
4. Select the **`Baud Rate`**.
   - 250 kbps (this is the default setting)
   - 500 kbps
5. If necessary, enter the **`ExDR-0201A Address`**: If the controller has been programmed with a different address, enter it here. The default value is 34.

ExDR-0201A Search

6. Click the **`Start`** button to begin searching for the device. Click **`Stop`** to cancel the search when *HF-Impulse* finds your controller. When the search is complete, select the device from the choices and click the **`Select`** button.

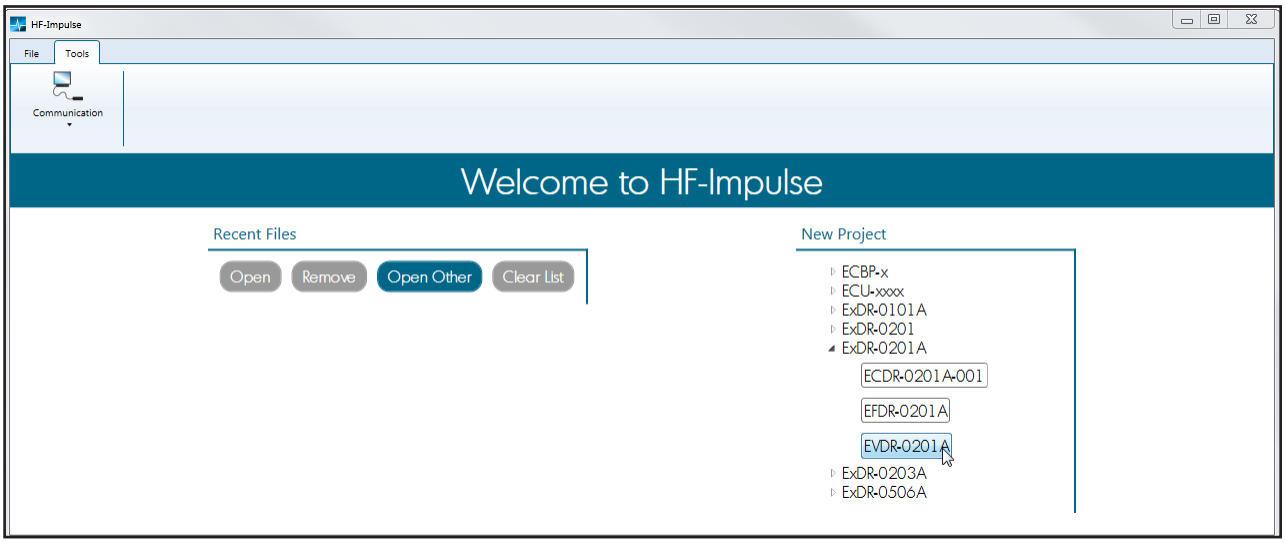
HF-IMPULSE COMMON FEATURES

Overview

This section details the features of *HF-Impulse* software common to all ExDR valve drivers. The EVDR-0201A and EFDR-0201A sections discuss settings particular to each firmware personality.

Welcome Screen

The *Welcome to HF-Impulse* screen allows you to choose recent projects or start new projects.



Recent Files is a record of previously opened projects. *HF-Impulse* displays the file path here. To choose one of the paths, select it and then click **`Open`**. To browse the computer and locate a project file, click **`Open Other`**. All *HF-Impulse* files have the *.icf file extension.

New Project is grouped by hardware type and then by firmware type. For example, one hardware type is *ExDR-0201A* and *EVDR-0201A* is a firmware (personality) type.

The welcome screen also lets the user directly access communication for the connected hardware. It is not necessary to open a project to check communication. The communication screen in this link is the same screen seen in the project named *Communication*.

Information Screen

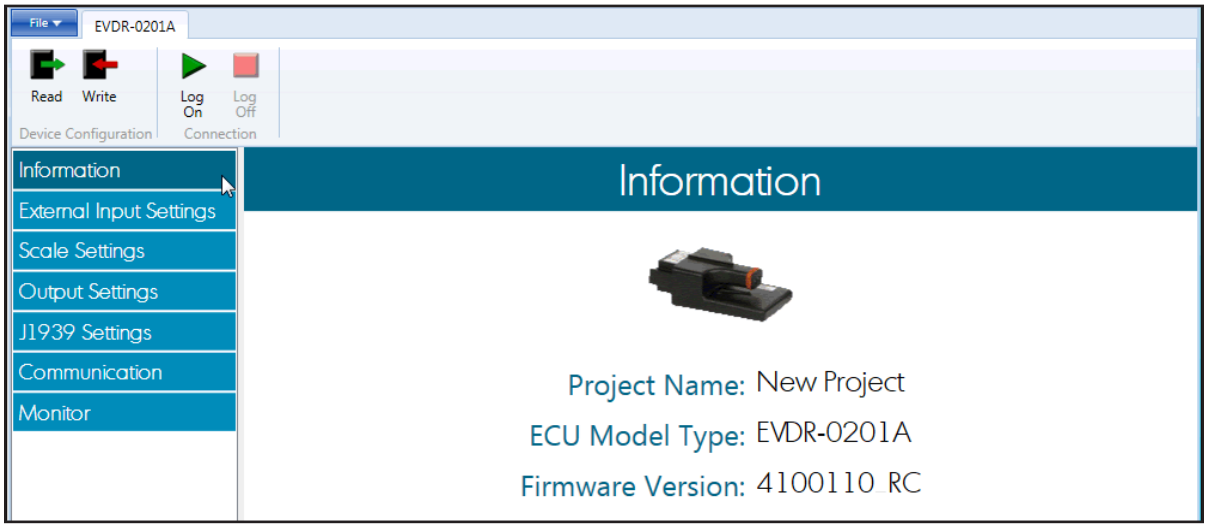
The *Information* screen shows the project name, model, and firmware.

The firmware version displays after *HF-Impulse* reads or writes settings to the controller. The firmware consists of a 6-digit number which identifies the model type.

- 4100110_R** is the EVDR-0201A.
- 4100114_R** is the EFDR-0201A.

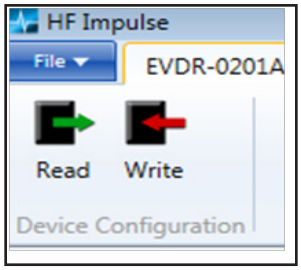
The _R** represents the version number. Prototype versions are the letters _RA thru _RZ. Production release versions are the numbers _R1 thru _R99. Use the Firmware Update utility on the Communication screen to update.

The *Project Name* is assigned when the configuration file is saved. The default name is *New Project*. To save the project with a new name, use **`File|Save As`**.

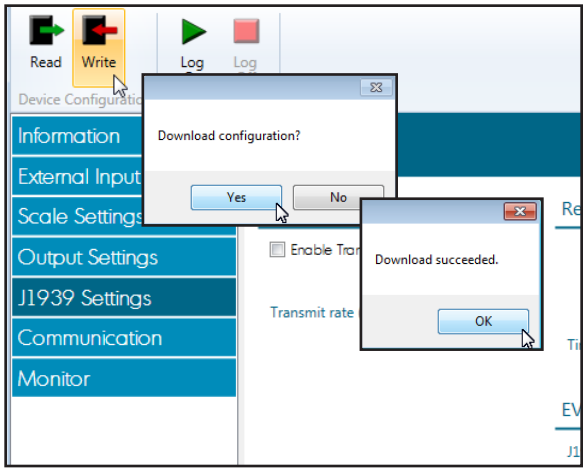


Reading and Writing Settings

Once communication is established the user can read or write the settings to the ExDR-0201A. Either operation affects all settings for each screen.

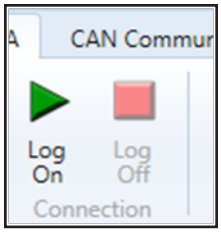


After the **`Write`** button has been clicked, *HF-Impulse* responds, asking to confirm download. A success message displays when complete.

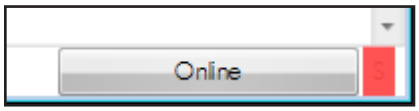


Logging On

Choosing **Log On** activates several useful features, including error condition status and an input and output monitor.



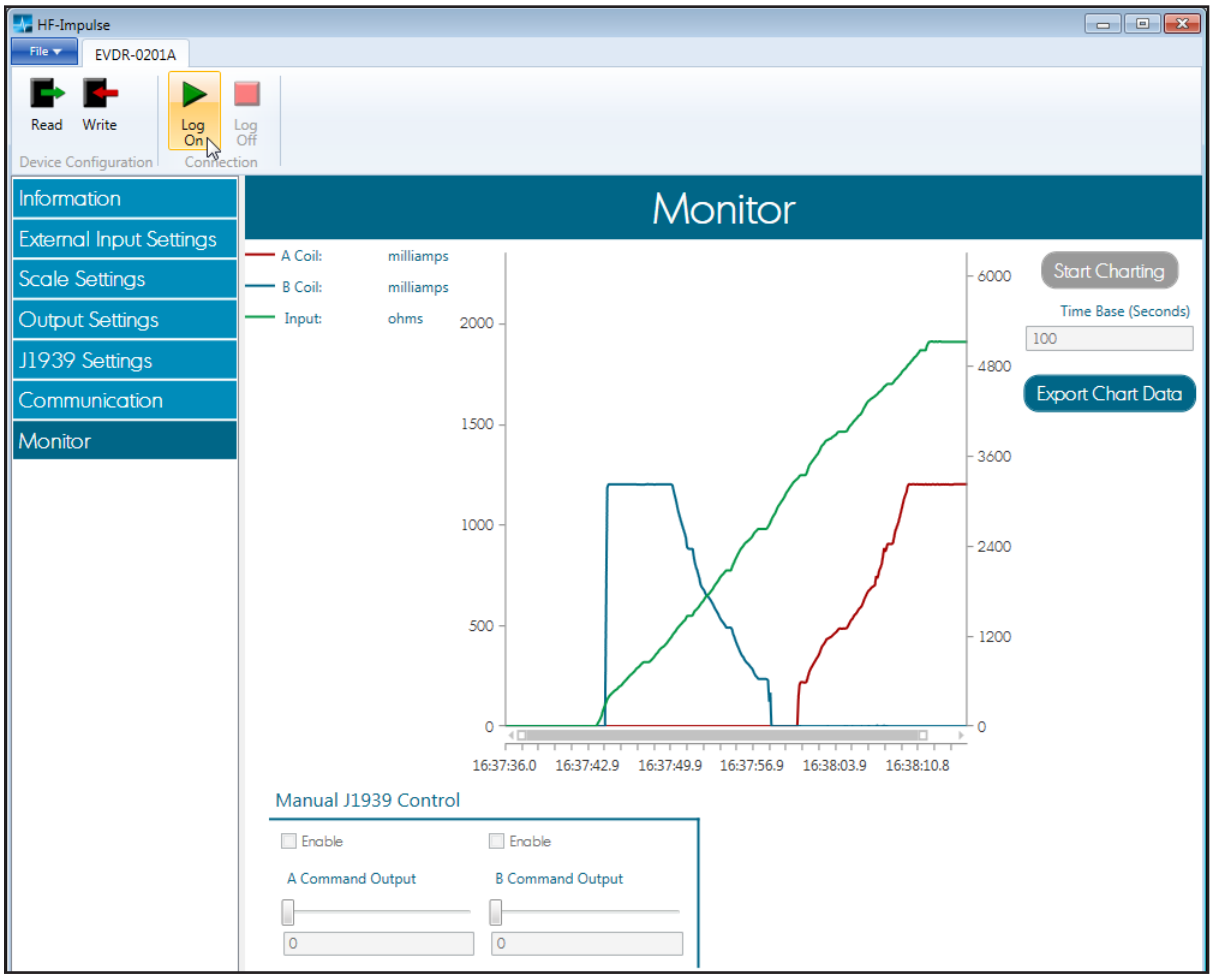
When logged on, *HF-Impulse* receives DM1 error messages from the ExDR-0201A. When an error condition exists, the red indicator in the lower right of the window flashes.



A description of the error condition also displays in the lower left of the window.

Monitor Screen

The *Monitor* screen becomes active when logged on. The input and output values plot as a chart recorder. When logged on, the manual controls on the *Monitor* screen also become active. *HF-Impulse* then monitors valve operation in real time, which is helpful for tuning and troubleshooting.



The chart area plots the *A Coil*, *B Coil*, and *Input* values over time. The Y axis on the left side is scaled from 0 to 2000 milliamps for the coil outputs. The Y axis on the right side is scaled in units based on the external input value. The X axis is scaled in time based on the entry in the *Time Base* box. Change *Time Base* as desired. *HF-Impulse* captures 10 samples per second.

A coil values plot in red, B coil values plot in blue, and the external input value plots in green.

The chart area X axis contains a scroll bar which allows the user to zoom into sections of the chart. To zoom, hover over the ends of the gray time bar. The mouse icon changes to a double arrow. Then click and drag the bar to zoom in and out of the chart timing.

To stop the chart and export the data from the chart, click on **`Export Chart Data`**. A file browser opens. Name a path and file for the data. The data becomes a .csv file.

The *Manual J1939 Control* allows the user to send J1939 messages to the ExDR-0201A. To activate, first configure the ExDR-0201A for J1939 control with the **`Scale Settings/J1939 Settings`**. The Enable check boxes in this section open for change. Once online click the **`Enable`** check box. *HF-Impulse* begins to transmit the J1939 message with the data in the entry box. Then move the slider or enter the values into the entry box. The range of values is limited based on the settings on the J1939 Settings page.

Communication Screen

The Communication screen is accessible from the welcome screen or from the project. The user can configure the USB to CAN communication, search for a ExDR-0201A on the network, or transfer firmware.

Communication Device

The ExDR-0201A connects to PCs with the Kvaser or PEAK USB adapters. These devices are available from HydraForce or from other sources and must be correctly installed to the PC.

The CAN network must be electrically correct for operation. At least one 120 ohm resistor must exist across the CAN lines. HydraForce offers a testing harness that connects the USB/CAN adapters directly to the ExDR-0201A. This harness includes the 120 ohm resistor.

Baud rate selections are 250k or 500k per J1939 standards. This setting only affects the *HF-Impulse* link to the ExDR-0201A.

To change the baud rate of the ExDR-0201A, go to the J1939 Settings page and change the baud rate. Then, write the settings to the ExDR-0201A.

Once new baud rate settings are written to the ExDR-0201A, the baud settings here must be changed to match them. This allows re-establishing *HF-Impulse* communication.

Use the ExDR-0201A address to connect *HF-Impulse* to the ExDR-0201A. This setting only affects the *HF-Impulse* link to the ExDR-0201A. To change the address of the ExDR-0201A, go to the J1939 Settings page and change the J1939 address. Then write the settings to the ExDR-0201A.

Once new J1939 address settings are written to the ExDR-0201A, the address setting here must be changed to match them. This allows re-establishing *HF-Impulse* communication.

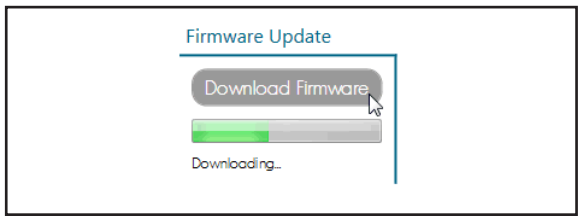
ExDR-0201A Search

The search function looks for all J1939 devices on the network using the *Address Claimed* request. The request is made for all addresses from 1 to 240. If the device discovered is an ExDR-0201A device, it is listed with its address and model description in the display window. All other devices are listed with their address and unknown as the model.

Stop the search at any time with the **`Stop`** button.

When the search is stopped, select the found address by clicking on the device in the search window, and then clicking the **`Select`** button. This transfers the address to the *ExDR-0201A Address* entry box.

Firmware Update



The ExDR-0201A models ship with firmware installed. Use the Firmware Install utility found on the Communication screen to upgrade or change the model.

The user can choose to convert from an EVDR to an EFDR using the firmware update. The firmware does not write the parameter settings, so start a new EFDR project and write parameters to the unit. The EVDR and EFDR use different parameter sets so it is important to write the settings before using the device.

To upgrade firmware, click the **`Download Firmware`** button to flash the ExDR-0201A with current firmware. Locate the image when prompted.

The firmware file names are the 6 digit part number and the version number.

- 4100110_R**.hex is the EVDR-0201A.
- 4100114_R**.hex is the EFDR-0201A.

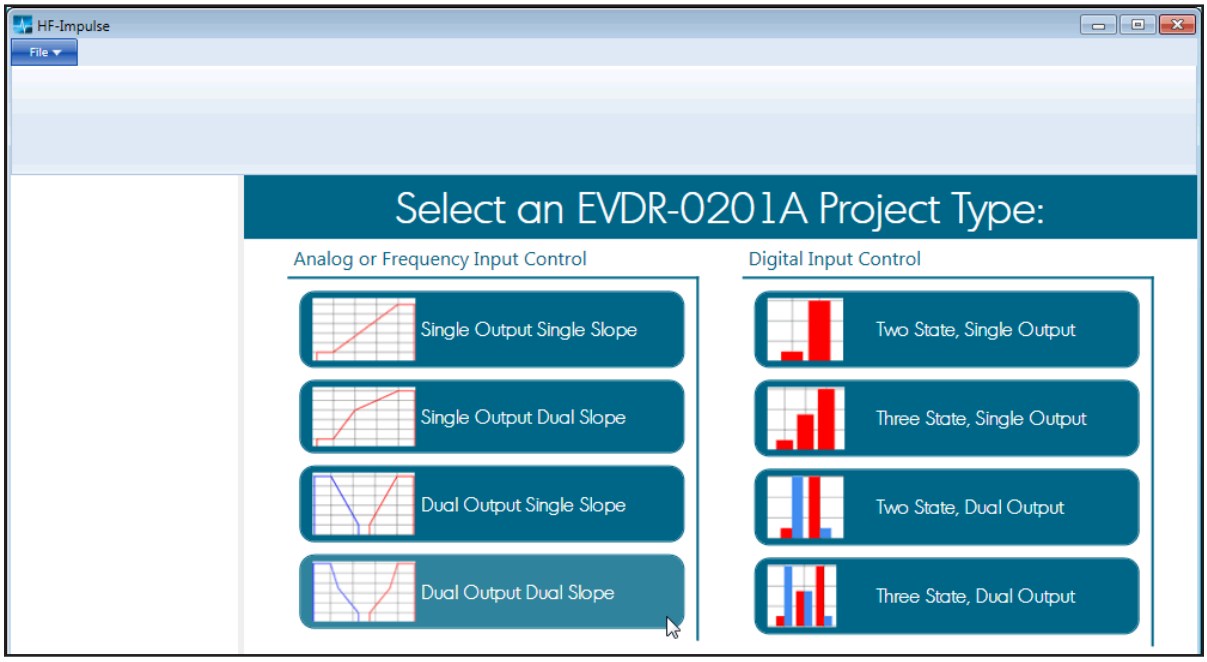
The _R** represents the version number. Prototype versions are the letters _RA thru _RZ. Production release versions are the numbers _R1 thru _R99.

Note: *Before you can update the firmware in your ExDR-0201A, you must download the latest image from the electronics portal at www.hydraforce.com/electronics. Check the image number and revision to ensure it is the correct firmware for your device.*

Starting a New Project

On the welcome screen choose **EVDR-0201A** from the *New Project* column.

Select the predefined project type closest to your needs. This loads a project with most of the common settings. Modify your selection as needed for your application. The predefined project types below are a starting point for configuration.

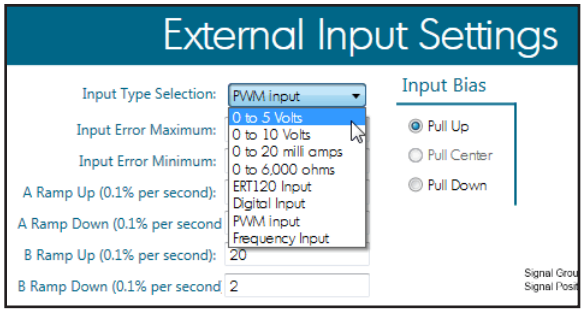


External Input Settings

The *External Input Settings* screen contains controls for the external electrical input pin of the EVDR-0201A. This pin is configurable to receive different types of electrical signals. Error limits for the electrical signal are also found on this screen. A three-category selection determines the bias on the pin with *Pull Up*, *Pull to Center*, and *Pull Down* selections. Refer to the *ExDR-0201A Technical Reference* for more information about the electrical characteristics.

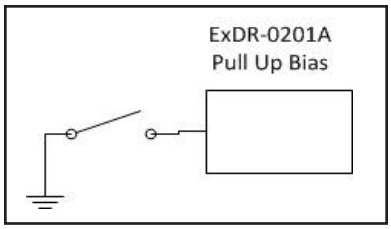
Select an input type from the choice list:

- 0 to 5 Volts
- 0 to10 Volts
- 0 to 20 milliamps
- 0 to 6000 ohms
- ERT120 Input
- Digital Input
- PWM Input
- Frequency Input

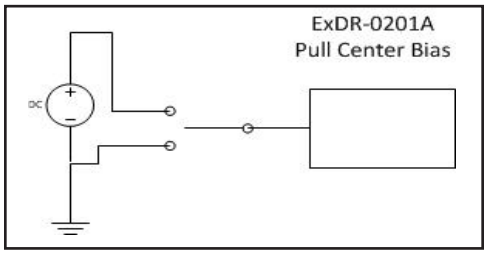


If you selected a digital input, PWM input, or frequency input, select the **`Input Bias`**:

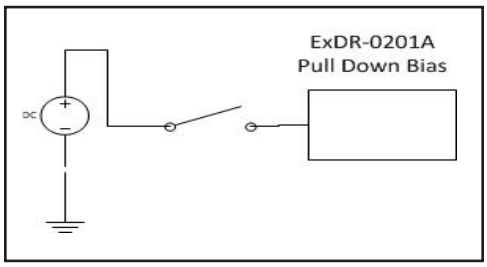
- *Pull Up*—an internal resistor biases the input pin to supply voltage: for sinking devices. When using as a digital input, wire the switch between ground and the input.



- *Pull Center*—only available with digital type. An internal resistor biases the input pin to 3.3 volts. Provides three-state selection: high/low/float. Use a three-position switch with the poles wired to ground and positive supply and the throw wired to the input.



- *Pull Down*—an internal resistor biases the input pin to ground: for sourcing devices. When using as a digital input, wire the switch between positive supply and the input.



Note: *Selecting* **`Pull Center`** *creates a three-state digital input (high/low/float).*

Input Error Maximum: signal above this value sets fault condition. When the value is at full scale, the error control turns off. In this case there is no trigger of the error when the input is greater.

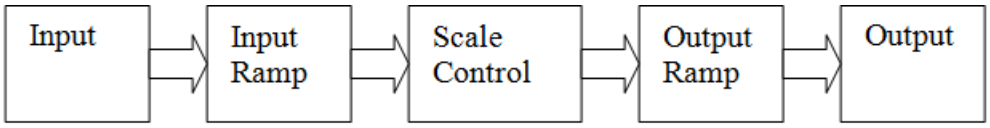
Input Error Minimum: signal below this value sets fault condition. When the value is zero, the error control turns off.

Note: *Error signal minimum/maximum values define conditions that generate an error message on the CANbus. Message parameters are available in the J1939 Settings group.*

Ramp Up (units per second): this acts as an input delay for input signals that increase in value. This ramp value makes the output current follow the profile created on the Scale Settings screen.

Ramp Down (units per second): this acts as an input delay for input signals that decrease in value. This ramp value makes the output current follow the profile created on the *Scale Settings* screen.

The input ramps are different from the output ramps because they are processed before the scaling control. The output current waveform follows the path created by the scale settings profile. Do not use the input ramp and output ramp in the same application, because it could be difficult to predict the result.

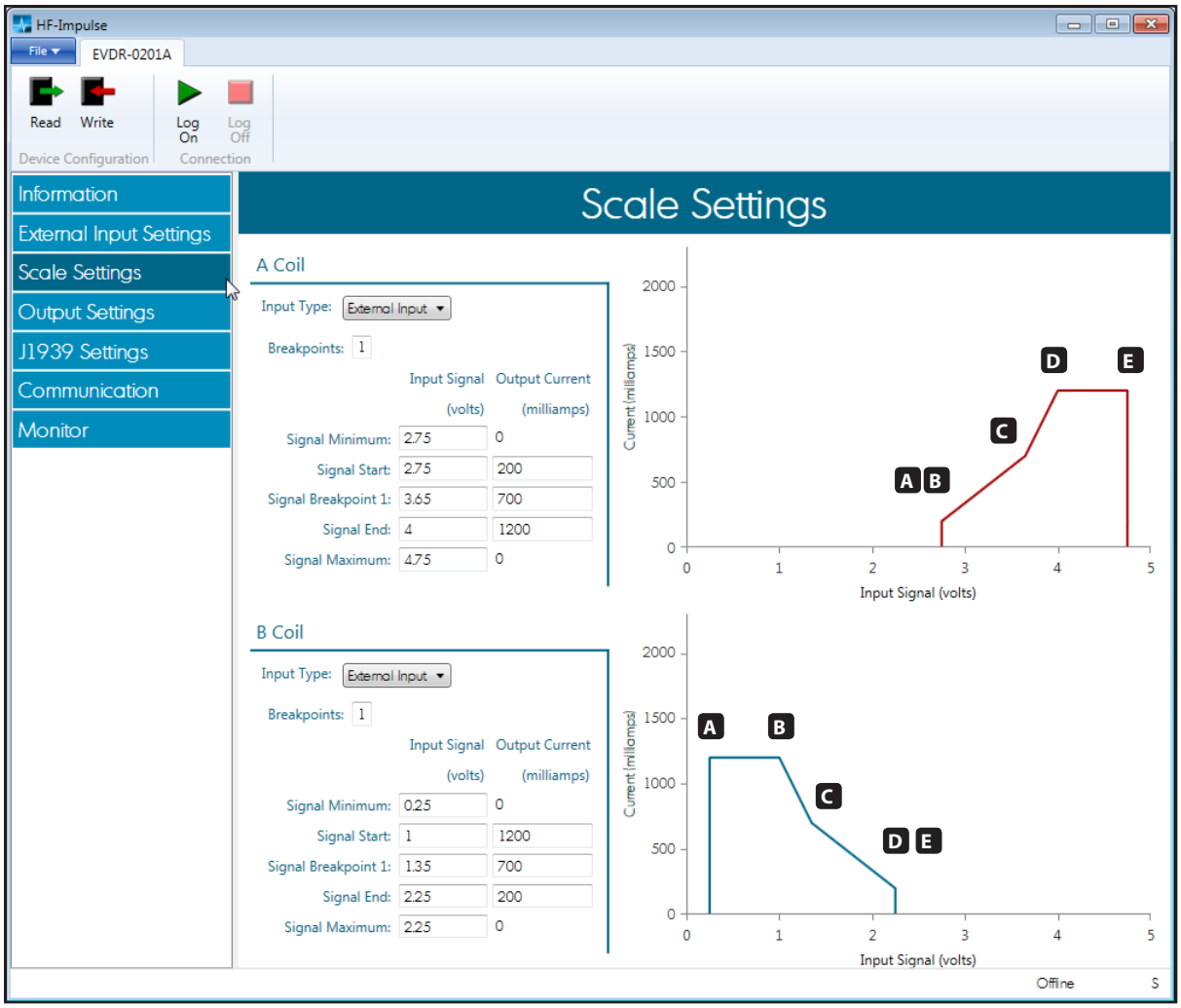


Note: *Do not use ramp values that are too small. The delay then becomes so slow that the EVDR-0201A appears not to react.*

Scale Settings

The *Scale Settings* screen contains the ratio control of the input to output signal. A graph represents the ratio of input signal to output current. The two outputs each have their own section. A selector for each output section allows either the external input as the provided signal or a J1939 message value as the control input. Turn off the output by selecting **`Not Used`**.

The software uses two types of graphs. For analog inputs the graph is line-type and plots from point to point. For digital inputs a column-type graph is used with only two or three states.

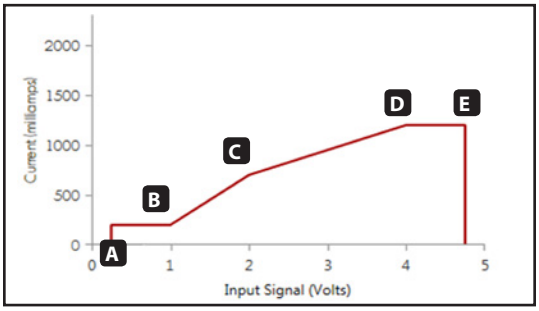


Select an input type from the choice list.

- *Not Used*—turns off the corresponding output.
- *External Input*—uses the settings from the External Input screen.
- *J1939 Message*—uses the settings from the J1939 Screen.

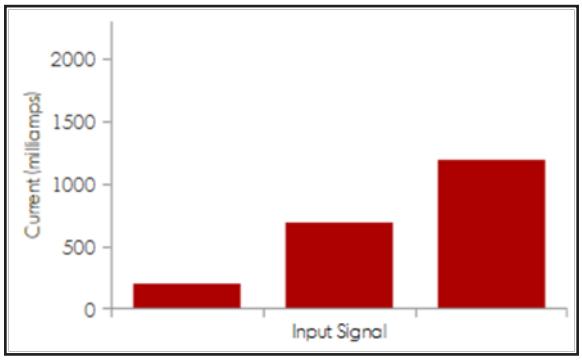
When using an analog input, change the breakpoints value to increase the number of points. The value defines the input to output profile.

- A: Coil signal minimum (deadband)
- B: Coil signal start
- C: Coil signal breakpoint 1
- D: Coil signal end: (end of second slope)
- E: Coil signal maximum: (deadband)

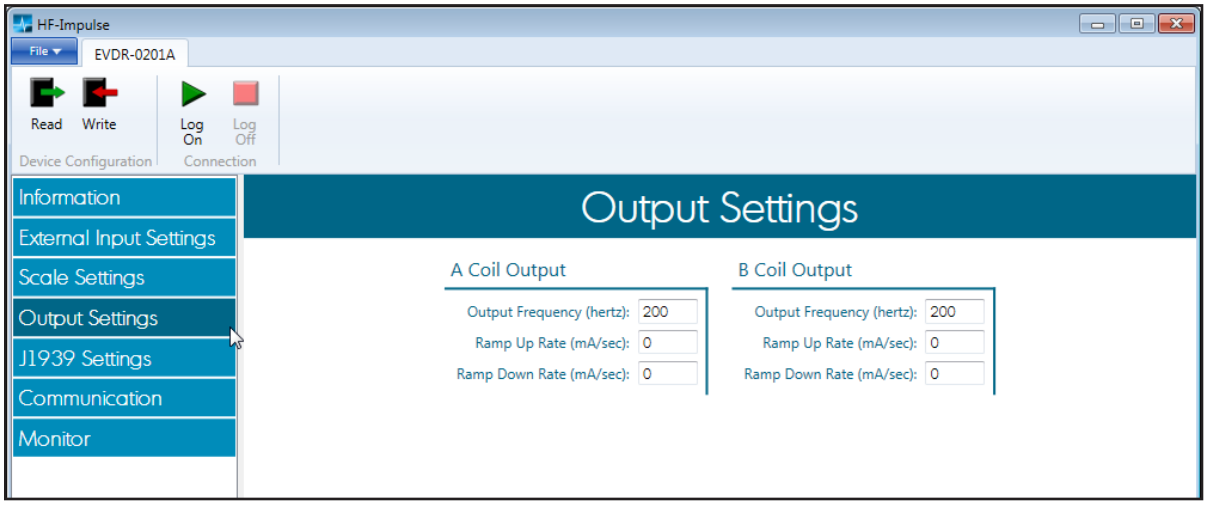


When the external input is set to digital, the following parameters are available to modify the output signal for three-state digital input:

- Switch to ground
- Switch to open
- Switch to battery (positive supply)



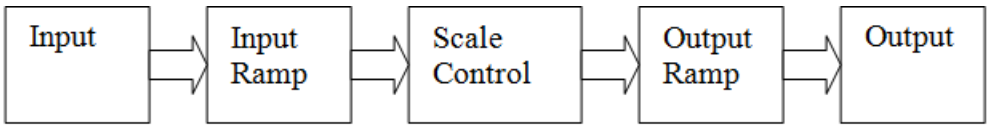
Output Settings



The *Output Settings* screen has sections for the A and B outputs. Each of these contain settings for output frequency, ramp up rate, and ramp down rate.

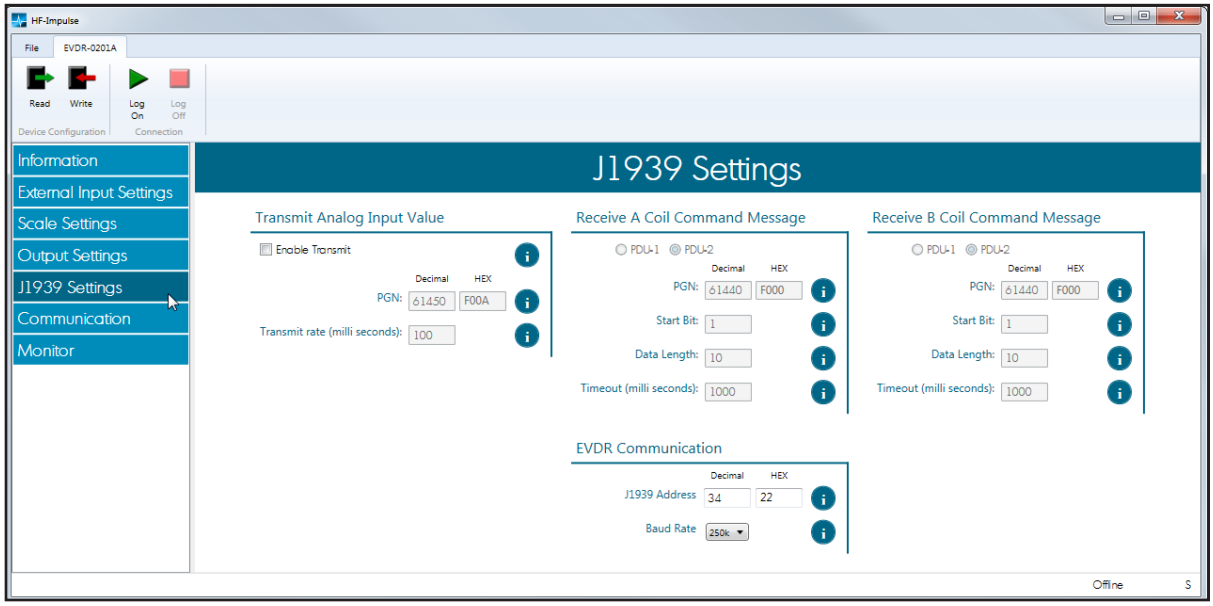
- *Output Frequency*—The range is 40 to 400 hertz. Refer to the specifications for the hydraulic valve to determine the best frequency.
- *Ramp Up Rate*—This can act as a delay to changes in increasing output current. The effect is for the rate of change for the increasing current to slow.
- *Ramp Down Rate*—This can act as a delay to changes in decreasing output current. The effect is for the rate of change for the decreasing current to slow.

The output ramps differ from the input ramps because they are applied after the scale settings control. Therefore the response is linear and does not follow the profile on the scale settings. The units are in milliamps per second. Do not use the input ramp and output ramp in the same application, because it could be difficult to predict the result.



Note: *Do not use ramp values that are too small. The delay becomes so slow that the EVDR-0201A appears not to react.*

J1939 Settings



Transmit Analog Input Value

The entry boxes are only enabled when the check box for *Enable Transmit* is selected. The PGN is part of the message id for the transmit message. The PGN can only be PDU2 format. Therefore there is no option for adding the destination address.

This control allows the EVDR-0201A to transmit a message containing the following data:

- Analog input value
- Coil A current
- Coil B current
- Power supply value

The bytes in the message are as follows:

- Byte 0 Analog input LSB
- Byte 1 Analog input MSB
- Byte 2 Coil A current LSB
- Byte 3 Coil A current MSB
- Byte 4 Coil B current LSB
- Byte 5 Coil B current MSB
- Byte 6 Power supply LSB
- Byte 7 Power supply MSB

The analog input value is found in the first two data bytes of the J1939 message, bytes 0 and byte 1. The units of the values vary based on the input type selected. The following describes the values.

- 0 to 5 volt 0 to 5000 millivolts
- 0 to 10 volt 0 to 10 000 millivolts
- 0 to 20 mA 0 to 20 000 micro amps
- 0 to 6000 ohm 0 to 6000 ohms
- ERT120 sensor 0 to 150 degrees Celsius
- Digital 0 or 5000 or 10 000 0=off, 5000=open, 10 000=on
- PWM input 0 to 1000 0.1% duty cycle
- Frequency 0 to 10 000 hertz

The coil current bytes 2 through 5 have value ranges from 0 to 2000 milliamps. The power supply value represents the measured DC supply to the EVDR-0201A. This value is contained in bytes 6 and 7. This value is in the range 0 to 33 000 millivolts.

Receive A Coil Command Message

This entry is enabled when you select J1939 as the input type for the A coil scaling on the *Scale Settings* screen. The PGN can be a PDU1 or PDU2 format. Add the destination address to the PGN number when using the PDU1 format. The *Start Bit* is a 1-bit to 64-bit based count. This can be confusing because some software starts bit count at zero.

Data Length can be 1 to 16 bits. The chart on the *Scale Settings* screen adjusts for the range selected here. If this value is changed, go back to the *Scale Settings* screen and adjust the settings to work as desired.

The *Timeout* selects the time before an error condition exists. The incoming message must periodically arrive before the timeout value. If the message does not arrive in this time, the unit shuts down all outputs and goes into an error state.

Receive B Coil Command Message

The B coil message works the same as the A coil message. It is only active when you select J1939 Message as the input type on the Scale Settings screen. The A message and the B message can have the same PGN, start bit, data length and timeout. In this case the B coil uses the same data as the A coil.

EVDR Communication

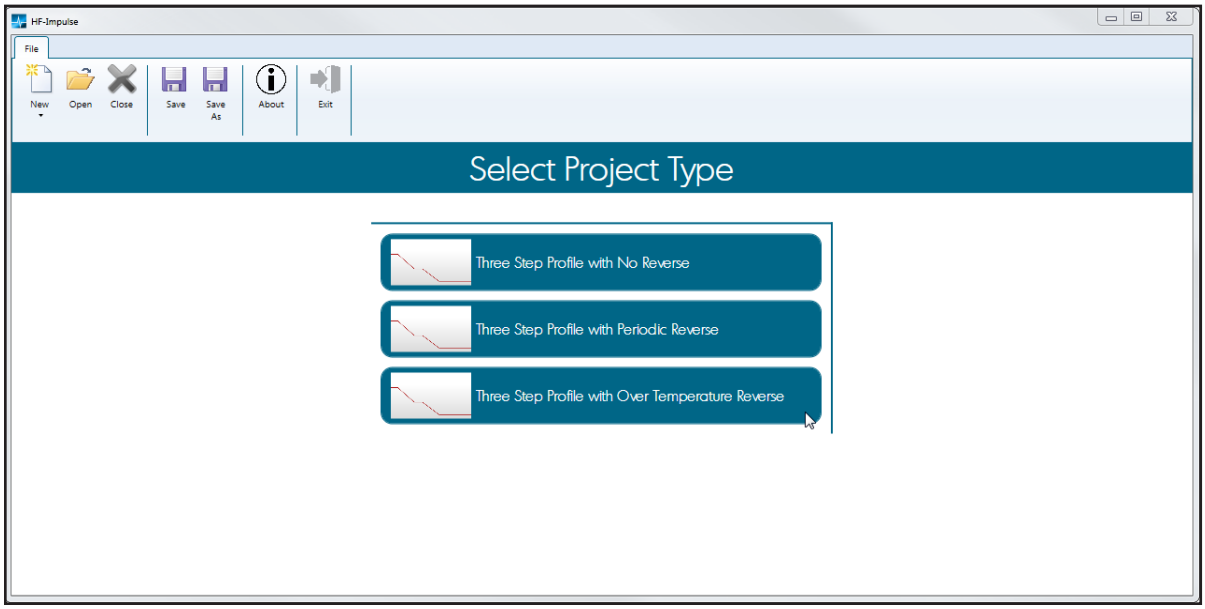
The EVDR-0201A uses these settings when connecting to the network. They include the J1939 address and the baud rate.

Monitor

See *Monitor Screen on page 9*.

Starting a New Project

EFDR-0201A fan drive firmware includes some predefined projects with different strategies to apply fan reversal using coil output B. Choose one of these three to begin. Choose any of the examples and modify as needed.



Three-Step Profile with No Reverse

This project has all the settings for the reverse sequence set to zero. It is intended to drive only the A coil output with no output to the B coil.

Three-Step Profile with Periodic Reverse

This project has a reverse sequence configured with a periodic reverse sequence. The reverse sequence occurs every 1800 minutes or 30 hours. You can reduce this to 180 minutes or 3 hours.

Three-Step Profile with Over Temperature Reverse

This project works with HydraForce ERT120 temperature sensor. When the temperature exceeds 145 °C, the driver triggers the reverse sequence.

External Input Settings

The *External Input Settings* screen contains controls for the external electrical input pin of the EFDR-0201A. This pin is configurable to receive different types of electrical signals. Error limits for the electrical signal are also found on this sc reen. A two-category selection determines the bias on the pin with *Pull Up* and *Pull Down* selections. Refer to the *ExDR-0201A Technical Reference* for more information about the electrical characteristics.

Select an input type from the choice list:

- 0 to 5 Volts
- 0 to 10 Volts
- 0 to 20 milliamps
- 0 to 6000 ohms
- ERT120 Input
- PWM Input
- Frequency Input

If you selected a PWM input or frequency input, select the input bias*:*

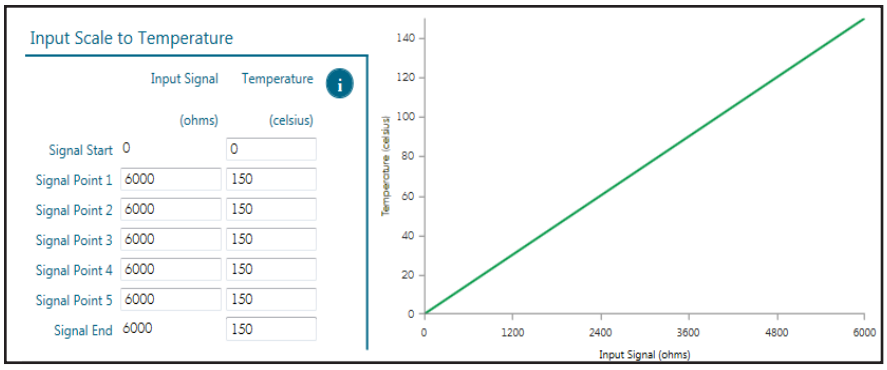
- *Pull Up*—an internal resistor biases the input pin to supply voltage: for sinking devices.
- *Pull Down*—an internal resistor biases the input pin to ground: for sourcing devices.

Input Error Maximum: signal above this value sets fault condition. When the value is at full scale, the error control turns off. In this case there is no trigger of the error when the input is greater.

Input Error Minimum: signal below this value sets fault condition. When the value is zero, the error control turns off.

Note: *Error signal minimum/maximum values define conditions that generate an error message on the CANbus. Message parameters are available in the J1939 Settings group.*

Input Scale—This converts the external input value to a temperature value in Celsius. It includes 7 points, which allows rough curve fitting. A chart plot indicates how the conversion responds. When using the ERT120 temperature sensor, the input scale is not necessary because the input is automatically converted to degrees C.

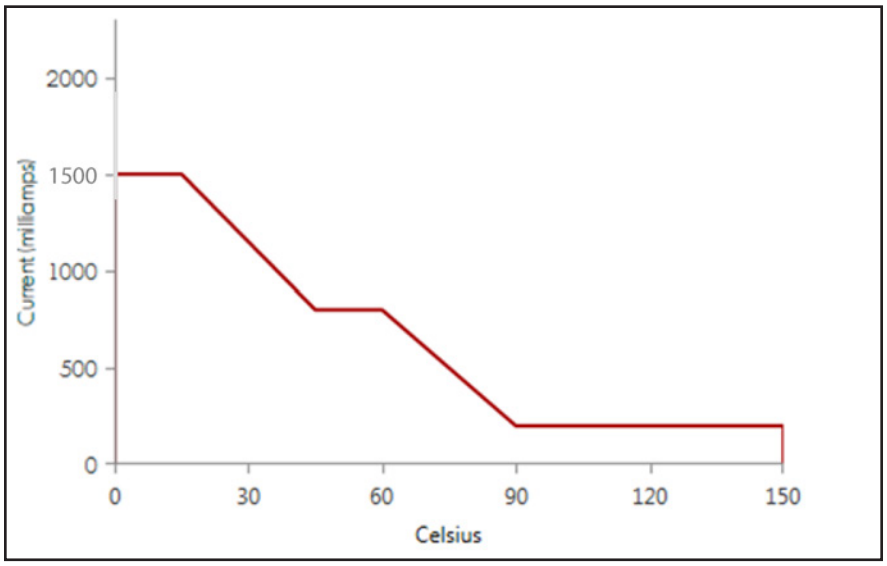


Scale Settings

The Scale Settings screen contains the ratio control of the input to output signal for the A coil when the reverse sequence is not running. A graph represents the ratio of input to output current. A selector allows either the external input as the provided signal or a J1939 message value as the control input. The external input selection is the converted temperature value from the *External Input Settings* screen.

The values which will define the input to output profile.

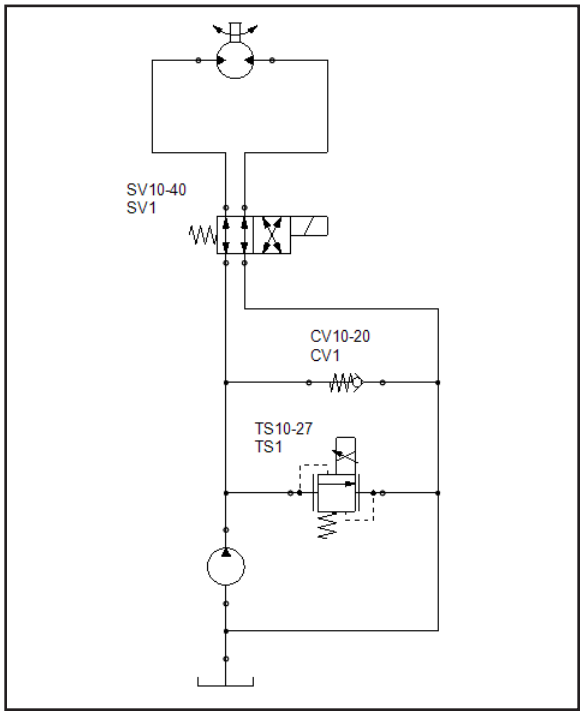
- A: Coil signal minimum (deadband)
- B: Coil signal start
- C: Coil signal breakpoint 1
- D: Coil signal breakpoint 2
- E: Coil signal end
- F: Coil signal maximum: (deadband)



Reverse Sequence

Reverse Settings

The reverse sequence control works with a hydraulic motor, a proportional speed control valve, and a directional control valve. Here is a schematic of a typical hydraulic arrangement.



The reverse sequence controls both the A and B coils, once triggered it runs until completion. The *Reverse Sequence* screen is divided into three sections:

- Control settings
- Sequence timing
- Chart

Control Settings

The reverse mode determines how the reverse sequence is triggered. During the reverse sequence, the scale settings control will not influence the A coil output.

- *Not Used*—disables the reverse sequence control. Only the A coil will be active with the scale settings.
- *Over Temperature Continuous*—in this mode the reverse sequence is triggered when the external input temperature is greater than the overtemperature value. Once triggered, sequence stays in Step 3 (reverse) until the input temperature drops below the overtemperature value.
- *Over Temperature Once*—in this mode the reverse sequence is triggered when the external input temperature is greater than the overtemperature value. The sequence completes and the fan direction returns to forward. The sequence will not be triggered again until the input temperature drops below the overtemperature value and then rises above the value.
- *J1939 Trigger Reverse*—in this mode the driver triggers the reverse sequence when the J1939 message value is greater than the J1939 switch point. When the sequence ends, if the message value is greater than the J1939 switch point, then the sequence will be triggered a second time. The reverse lockout can be used to delay a second trigger.
- *Periodic Reverse*—in this mode the driver triggers the sequence periodically based on the periodic reverse time. This value represents the time between sequences. So if the periodic reverse time is 10 minutes and the reverse sequence is 5 minutes, then the sequence triggers every 15 minutes.

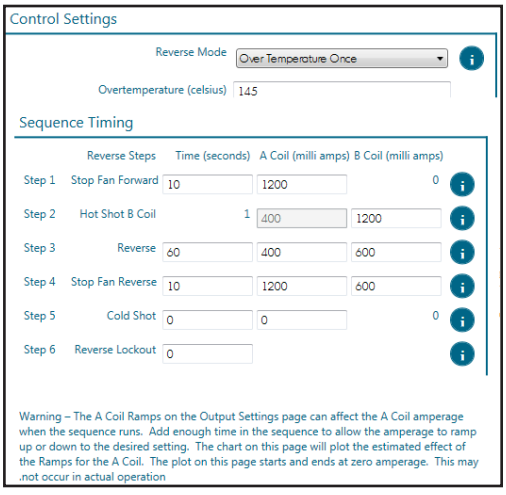
For each of the trigger states an entry box sets the level of the trigger. The entry boxes are:

- Overtemperature
- J1939 switch point
- Periodic reverse time

These entry boxes only display as required.

Sequence Timing

The sequence timing consists of a table of time events and the corresponding current for each event. The A coil and B coil have their separate entry boxes for values. There are a total of 6 steps in the sequence and they are as follows.



- *Step 1*—used for stopping the fan rotation before the direction change. Set the A coil amperage to the value which stops the fan from turning. Allow enough time for the fan to slow down to a stop and to account for any output ramps of the output current.
- *Step 2*—used to hot shot the B coil. This is intended to apply enough amperage so the B coil valve shifts. Most valves take a large amount of amperage to shift the spool. But they require less amperage to maintain position. Therefore steps 3 and 4 can have lower B coil amperage values. The fixed time for this step is 1 second, which should be enough time for the valve to shift.
- *Step 3*—the reverse run time. In this step the B coil amperage can drop to a lower holding current to maintain direction. Set the A coil amperage to run the fan at speed for the entire reverse period. Set the time to the desired duration of the reverse run.
- *Step 4*—used to stop the fan. Set the A coil amperage to a value which stops the fan. Set the B coil amperage to the same value as in *Step 3*. This maintains the fan direction. Allow enough time for the fan to slow down to a stop and to account for any ramps of the output current. *Step 1* and *Step 4* values are linked since both settings are meant to stop the fan.

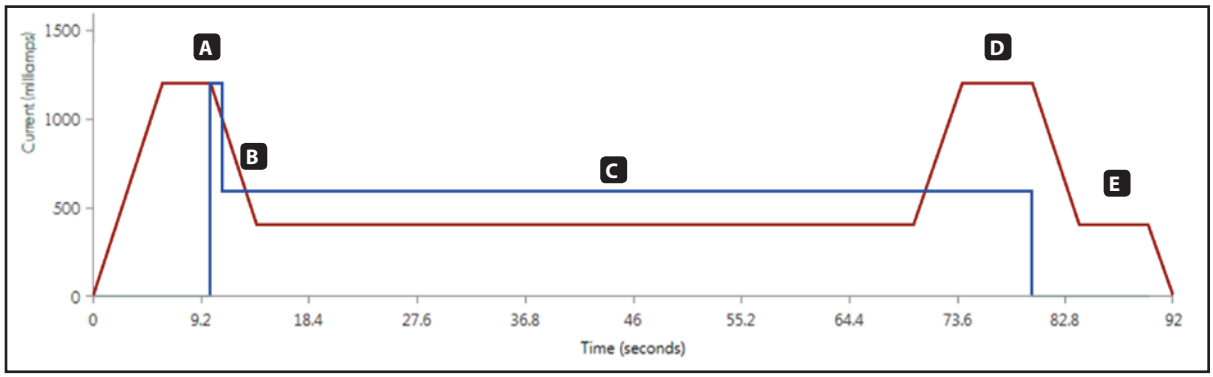
- *Step 5*—used to run the fan in the forward direction at a high speed. Use this burst of speed to add additional cooling or help remove debris from the radiator. A time value set to zero disables this step. During this step the B coil amperage goes to zero amps.
- *Step 6*—used to prevent the sequence from running a second time. The trigger used to start the sequence is ignored until this timer has completed.

Reverse Sequence Chart

The sequence chart graphically represents the sequence timing. The A coil values plot in red and the B coil values plot in blue. The plots change as the user enters values in the timing table. The charts also simulate the effects of the output ramp settings on the *Output Settings* screen. The Y axis is scaled in milliamps from 0 to 2000 and the X axis automatically adjusts to the time settings in the table.

The values which define the timing profile are:

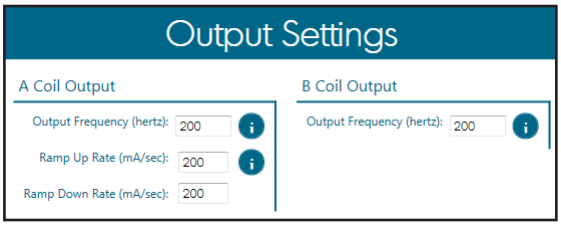
- A: Stop fan forward
- B: Hot shot B coil
- C: Reverse
- D: Stop fan reverse
- E: Cold shot



The ramp settings on the *Output Settings* screen cause the slopes in the chart. Be sure to allow enough time for the ramps. Otherwise the coils may not reach the intended amperage.

Output Settings

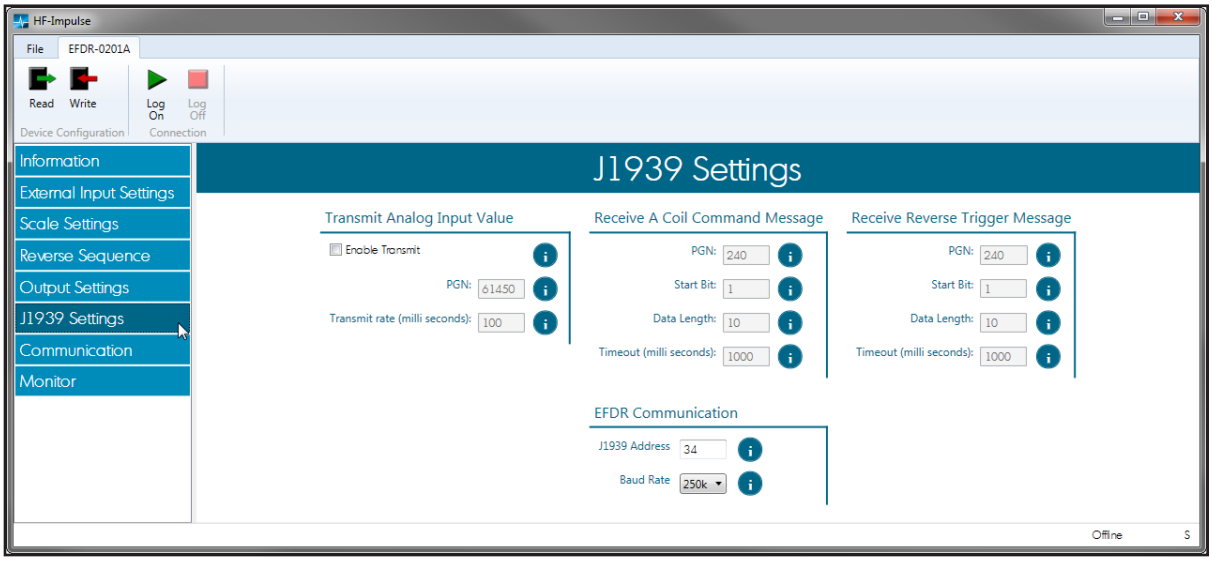
The *Output Settings* screen has sections for the A and B outputs. Each of these contain settings for output frequency. But only the A coil output has settings for ramp up rate and ramp down rate.



- *Output Frequency*—The range is 40 to 400 hertz. Refer to the specifications for the hydraulic valve to determine the best frequency.
- *Ramp Up Rate*—This can act as a delay to changes in increasing output current. The effect is for the rate of change for the increasing current to slow.
- *Ramp Down Rate*—This can act as a delay to changes in decreasing output current. The effect is for the rate of change for the decreasing current to slow.

J1939 Settings

The J1939 settings for the EFDR-0201A work the same as the EVDR-0201A. The exception is how the B coil message works. The message value does not directly drive the B coil amperage. Instead it serves as a trigger to the reverse sequence.



Monitor

The EFDR-0201A *Monitor* screen works the same as the EVDR-0201A, with the exception that it receives an additional plot of temperature. This temperature value is received from the EFDR-0201A and represents its conversion of the external input signal to a temperature value. See *Monitor Screen on page 9*.

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