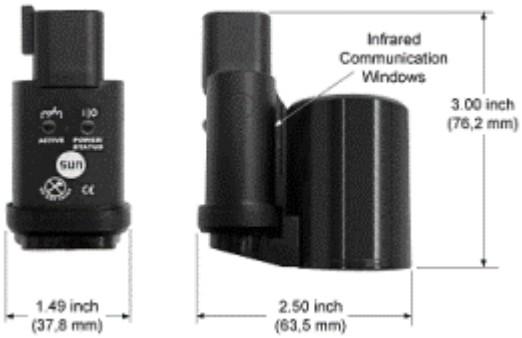
12 VDC coil with embedded ramping function - Deutsch DT04-6P connector

Model:
790-4F12V

The Embedded Electronics Amplifier is a compact, low profile coil/controller combination for use with proportional solenoid valves. The Amplifier provides current to the coil in proportion to a specified time constant. Bright LED indicators on the unit provide an overview of the operating status. Setup is accomplished through a convenient Hand Held Programmer (HHP). There is no cover to remove and no tiny pots to set. Once configured, the settings are stored in permanent memory within the unit. With power applied, the ramping amplifier outputs the specified minimum current. Applying a voltage (minimum 9 V) to the command pin initiates the specified ramp up in current. Removing the command signal initiates the ramp down in current.



Technical Features

- Easily configured using Sun's hand held interface
- Selectable dither frequency up to 300 Hz including OFF. Sun's recommended dither frequency is 140 Hz.
- All input and output limits are independently adjustable
- Microprocessor controlled for consistent, reliable performance
- Deutsch DT04-6P Connector, IP69K rated
- Glass filled nylon enclosure with Lexan light pipes and polyurethane potting compound
- LED indication of Status and Output Current
- Adjustable current limited output with short circuit protection
- Adjustable ramp up and ramp down times, independently set
- CE approved - Emissions Test: EN55011, Immunity Test: EN61326
- Separate supply and command common
- Power cable with mating connector is required and is not included with product.

Technical Data

	U.S. Units	Metric Units
Output Current	1200 mA	
Analog Input Impedance	13 Kilo-ohms	
Analog Input Range	9-28 V	
Card Function	Ramping Amplifier	
Dither Settings	Off, 80-300 Hz, in 20 Hz increments	

Ramp Time	0-120.0 s, 0.5 s increments	
Supply Current	I(sol) + 20mA	
Voltage/Frequency	12 VDC	
Supply Voltage	9-28 VDC	
Operating Temperature Range	-20 to 70 °C	
Connector	Deutsch DT04-6P	
Model Weight	0.35 lb.	0.16 kg.

790-4F12V

What models can this kit be used on?

	FMDB	FPCH	PRDM	PRDP	PSDP	RBAN	RBAP
FMDA	FPCC	PRDL	PRDN	PSDL			

Display Components

	Description	Quantity
753-025	Electrical Components	1
790-012	Electrical Components	1
753-028	Electrical Components	2
753-029	Electrical Components	2
753-036	Electrical Components	1
999-991-235	Information Sheet	1

Embedded Electronics
Digital Proportional Valve
Ramping Amplifier

790-4F24V
790-4F12V

The Embedded Electronics Amplifier is a compact, low profile coil/controller combination for use with proportional solenoid valves. The Amplifier provides current to the coil in proportion to a specified time constant. Bright LED indicators on the unit provide an overview of the operating status. Setup is accomplished using Sun's PC-based Amplifier Set Up Software or Hand Held Programmer (HHP). There is no cover to remove and no tiny pots to set. Once configured, the settings are stored in permanent memory within the unit. With power applied, the ramping amplifier outputs the specified minimum current. Applying a voltage (minimum 9 V) to the command pin initiates the specified ramp up in current. Removing the command signal initiates the ramp down in current.

- Easily configured using Sun's hand held interface or PC-based software
- LED indication of Status and Active
- Deutsch DT04-6P Connector, IP69K rated
- Selectable dither frequency up to 300 Hz
- All input and output limits are independently adjustable
- Adjustable ramp up and ramp down times, independently set
- Microprocessor controlled for consistent, reliable performance
- CE approved – Emissions test: EN55011: 1998/A1: 1999, Immunity test: EN61326: 1997/A1: 1998/A2: 2001

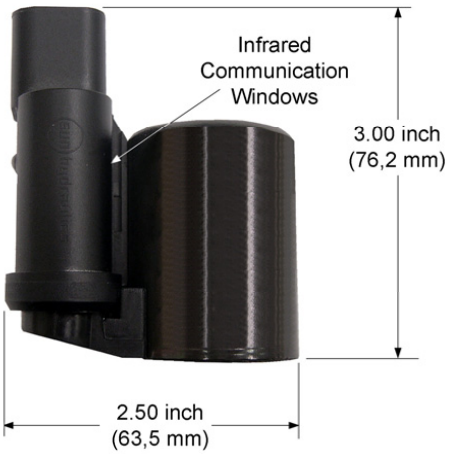
Operating Specifications:

Supply Voltage	**790-4F24V**: 21.6-28 V, 24V Recommended **790-4F12V**: 10.8-28 V, 12V Recommended
Supply Current	I_{SOL} + 20 mA
Output Current	**790-4F24V**: 24 V Coil, 600 mA max. **790-4F12V**: 12 V Coil, 1200 mA max.
Dither Settings	80-300 Hz, 20 Hz increments
Analog Input Range	9 – 28 V
Analog Input Impedance	13 KΩ
Operating Temperature Range	-4° F to 158° F (-20° C to 70° C)
Enclosure	Glass filled nylon with Lexan light pipes, polyurethane potting compound
Ramp Up Time	0 – 120.0 s, 0.5 s increments
Ramp Down Time	0 – 120.0 s, 0.5 s increments

Physical Description

The Embedded Ramping Amplifier is shown at the right. There are two indicator lamps labeled STATUS and ACTIVE. The STATUS lamp will light green whenever power is applied to the unit and is within the specified voltage range. The STATUS light will flash red when a fault has occurred. The type of fault is indicated by the number of successive flashes. It will continue to flash until the command signal has been removed to clear the fault. The amber lamp labeled ACTIVE provides an indication of the current being supplied to the solenoid outputs.

Communication with the Embedded Ramping Amplifier takes place through two infrared communication windows. These windows allow for configuration and monitoring of the operating parameters, and therefore must remain free from any obstruction such as paint or other material. The infrared adapter cable clips onto the Embedded Ramping Amplifier in the notches located between the coil housing and amplifier section.



User Interface

The Embedded Ramping Amplifier has a number of internal settings which allow each unit to be configured for the application in which it is used. These settings are accomplished using Sun's PC-based Amplifier Set Up Software or Hand Held Programmer (Sun p/n 991-700). Infrared Cables are available to communicate between the Amplier and the PC or the HHP (USB cable p/n: 991-704 and Serial cable p/n: 991-702).

Parameter List

The following table outlines the parameter list for the Amplifier. Along with the name of the parameter and its type, the table lists the limits and units for each item.

Parameter	Type	Limits	Default Settings	Units
790-4F**V	FIXED			Version #
RAMP UP TIME	VARIABLE	0.0 to 120.0	0	Seconds
RAMP DOWN TIME	VARIABLE	0.0 to 120.0	0	Seconds
MINIMUM OUTPUT	VARIABLE	0 to 600 or 1200	0	mA
MAXIMUM OUTPUT	VARIABLE	0 to 600 or 1200	590 or 1150	mA
DITHER FREQ.	VARIABLE	Off, 80 to 300	140	Hz.
OUTPUT CURRENT	MONITOR			mA
SUPPLY VOLTAGE	MONITOR			Volts
FAULT STATUS	MONITOR			Fault

790-4FV –** This is the title parameter. The model number of the unit and the firmware version are displayed. The title parameter is fixed.

MINIMUM OUTPUT - The Minimum Output parameter represents the minimum current of the output. This is often referred to as the dead band. The value displayed represents the current in milliamps. The Minimum Output parameter is variable.

MAXIMUM OUTPUT - The Maximum Output parameter represents the maximum current of the output. This is often referred to as the gain. The value displayed represents the current in milliamps. The Maximum Output parameter is variable.

DITHER FREQ. - The Dither Frequency parameter has 13 options for dither control. The choices are Off, 80 to 300 Hz in 20 Hz increments. Dither control provides low frequency modulation which is required in many proportional valve applications. The Dither Frequency parameter is variable.

RAMP UP/DOWN TIME - Ramp Up Time and Ramp Down Time are used to limit the rate of change of the input command signal, and therefore the ramp time of the output. The amount of time required to ramp through the full input range is set by these parameters. When the input command is increasing, the Ramp Up Time is used. When the input command is decreasing, the Ramp Down Time is used. The Ramp Up/Ramp Down Time parameters are variable.

OUTPUT CURRENT - Output Current displays the nominal current being supplied to the output. The Output Current parameter is a monitor type.

SUPPLY VOLTAGE - The Supply Voltage parameter displays the module's power supply voltage. This value is included as an aid to troubleshooting. The Supply Voltage parameter is a monitor type.

FAULT STATUS - The Fault Status parameter displays the current fault code when a fault exists as shown in the table below. The Fault Status parameter is a monitor type. In addition to the on-screen fault status, the STATUS light will flash red indicating a problem. The light will flash a number of times periodically corresponding to the fault codes below.

Code	Fault	RED LED Flashes
1	Over Current	
2	Open Output	
3	Output Shorted	

Configuration

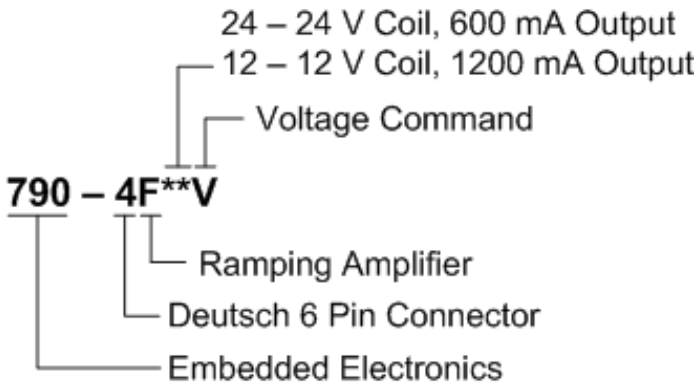
All of the amplifier set up operations are accomplished with the use of 4 buttons. These buttons are Lock, Unlock, Up, and Down. The Programmer represents these in graphical form as padlocks and arrows.

Both the PC-based set up software and the Hand Held Programmer have a two-line display. The up and down arrows are used to navigate through the parameter list. When either button is pressed, the display will be updated with the next parameter in the list. The parameter name will appear on the first line and the associated setting will appear on the second line. The list is accessed in a circular fashion, stepping down from the last parameter to the first and vice-versa.

To change the setting of a variable parameter, the user must press the unlock button to place the system in edit mode. While in edit mode, the display will show the Up and Down arrows together at the beginning of the second line. In edit mode, the up and down buttons are used to change the value of the parameter. For parameters which contain both variable and monitor data, the monitor data is shown surrounded by square brackets. Once the desired setting is displayed, pressing the lock button will save the parameter and end the edit mode.

Ordering Information

The following is a breakdown of the 790-4F**V part numbering system:



Wiring

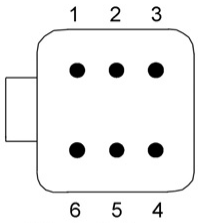
Wiring functions are listed in the table below. Following the table are wiring examples for various modes of operation.

Notes:

- To establish the infrared communications link, it is essential that the infrared communication windows remain free from any obstruction such as paint or other material.
- For acceptable EMC immunity, a shielded cable should be used. Shield drain should be attached to earth ground.
- For complete overload protection, a fuse should be installed as shown in the circuit diagrams.

Note: A source type input is required. A sinking type analog input will damage the amplifier.

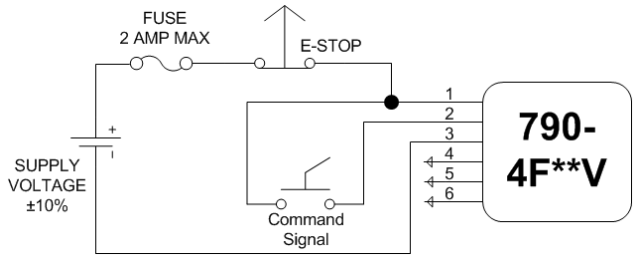
Terminal	Function
1	+V Supply
2	Command Signal
3	Supply Common
4	Not Used
5	Not Used
6	Not Used



DT04-6P Connector

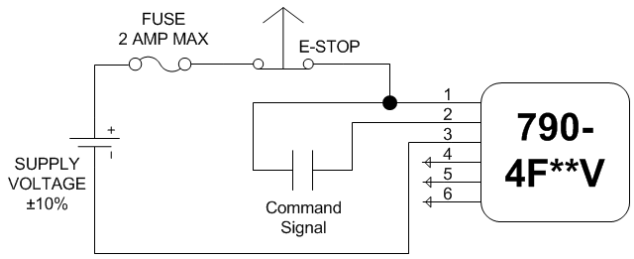
Single Solenoid Joystick Control

The Amplifier can be controlled with a joystick as shown.



Single Solenoid PLC Control

The Amplifier can be controlled with PLC as shown.



Setup Procedure

Note: Changing parameter settings may cause sudden and unexpected machine movements. Care must be taken to prevent injury, death, or damage of equipment.

1. Install the infrared Cable Adapter to the Embedded Ramping Amplifier paying particular attention to the orientation of the Adapter—the logo side should face away from the coil and towards the embedded amplifier. The connector end must connect to either a PC (with set up software loaded) or the HHP.
2. Power must be applied to the Embedded Amplifier. When using the HHP, turn on the HHP by briefly pressing the yellow power button marked with the international power symbol I|0. The title screen for the HHP should appear. When using the PC-based set up software, load the program.
3. Parameter definition should be set in the descending order as shown in the parameter table above to avoid a common mistake.
4. Pressing the green Unlock button when a variable parameter is displayed puts the amplifier into the edit mode.
5. Press the Down arrow to display the RAMP UP parameter. The number shown on the second line is the ramp time in seconds. A value between 0 and 120 seconds may be selected. Once a command signal is detected, the Amplifier will increase power to the coil in a linear manner over the ramp rate selected. Once the value has been selected, pressing the red Lock button commits the change to memory and exits the edit mode.
6. Press the Down arrow to display the RAMP DOWN parameter. The number shown on the second line is the ramp time in seconds. A value between 0 and 120 seconds may be selected. Once the command signal has been removed, the Amplifier will decrease power to the coil in a linear manner over the ramp rate selected. The RAMP UP and RAMP DOWN parameters are not required to be the same. Once the value has been selected, pressing the red Lock button commits the change to memory and exits the edit mode.
7. Press the Down arrow to display the MINIMUM OUTPUT parameter. This parameter is sometimes called dead band compensation. The first number shown on the second line of the display is the setting value while the number in square brackets is the monitored value currently present. Pressing the green Unlock button enters the edit mode to allow for the setting to be changed. Press the Up arrow to increase the value or press the Down arrow to decrease the value. The value specified is determined by what value of current is needed when the dead band has been minimized. A low value will increase the control resolution while a higher value will compensate for the difference for the current value between the valve components not moving and moving. Once the value has been selected, pressing the red Lock button commits the change to memory and exits the edit mode. Keep in mind the minimum output value is output to the coil with power applied and without a command signal.
8. Press the Down arrow to display the MAXIMUM OUTPUT parameter. Again the first number shown on the second line is the setting value while the number in square brackets is the monitored value currently present. Pressing the green Unlock button enters the edit mode to allow for the setting to be changed. Press the Up arrow to increase the value or press the Down arrow to decrease the value. The value selected is determined by the pressure or flow required at maximum power to the solenoid coil. However, the maximum current value should not exceed the recommended value for the coil being used. Exceeding the recommended value will dramatically shorten the life of the coil by producing excess heat. Presently, the recommended maximum current value for a Sun coil produced after January 2005 (black dichromate coil can) is 590 mA for a 24 Volt coil and 1150 mA for a 12 Volt coil. Selecting a value too low will limit the performance of the valve. Once the value has been selected, pressing the red Lock button commits the change to memory and exits the edit mode.
9. Press the Down arrow to display the DITHER FREQ. parameter. The number shown on the second line is the dither frequency in Hertz. Presently, the recommended dither frequency for Sun valves is 140 Hz. Dither is a small amplitude oscillation at the specified frequency used to reduce friction within the valve that allows for better performance. The lower the frequency, the larger the amplitude of oscillation and vice versa, the larger the frequency, the smaller the amplitude of oscillation. The amplitude is not user definable and cannot be set independently. Once the value has been selected, pressing the red Lock button commits the change to memory and exits the edit mode.
10. Setup of the Embedded Amplifier is complete. Continuing to press the Down arrow allows viewing of the monitored parameters supply voltage, output current, and fault status. The monitored parameters are useful in troubleshooting.