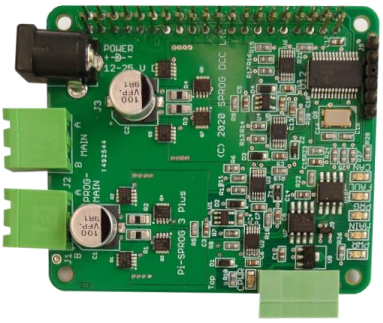
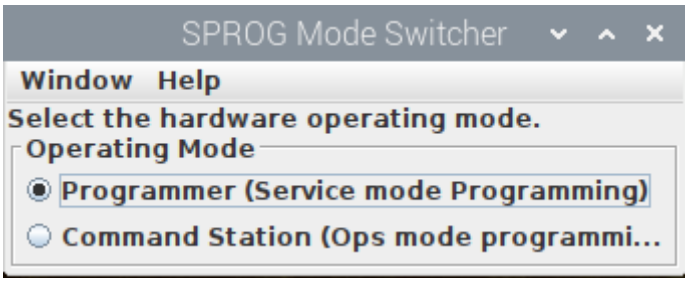
SPROG DCC

SPROG 3 Plus
Pi-SPROG 3 v2
Pi-SPROG 3 plus

DCC Decoder Programmer and Command Station

User Guide





Revision History

Date	Version	Firmware	JMRI	Comment
June-20	Draft 0.1	1.a.3	4.19.7	First version
December-20	Draft 0.2	2.a.1	4.21.3	V2 SPROG 3 Plus, Pi-SPROG 3 Plus
February-21	Draft 0.3	2.a.2	4.21.3	First draft release
Mar-21	1.0	2.b.1	4.21.3	Support for SPROG 3 v2
Apr-21	1.1	2.b.4	4.23.3	First Production release
Apr-21	1.2	2.b.5	4.23.3	Pi-SPROG 3 v2 Photographs, update Known Issues
May-21	1.3	2.b.6	4.23.4	

Firmware and JMRI columns refer to the earliest versions to which a User Guide version applies.

Acknowledgements

CBUS® is a registered trademark of Dr Michael Bolton.

Introduction

The SPROG 3 Plus, PI-SPROG 3 v2 and Pi-SPROG 3 Plus are DCC decoder programmers designed to support CBUS, a CAN based network developed by members of MERG for model railway control.

The SPROG 3 Plus connects to the USB port of a personal computer or similar device.

The Pi-SPROG 3 v2 and Pi-SPROG 3 Plus attach directly to the GPIO connector of a Raspberry-Pi computer. A Raspberry Pi 4 Model B is recommended for the best performance.

All are supported by the free JMRI software (http://jmri.sourceforge.net/).

For the remainder of this document references to SPROG 3 Plus apply equally to the Pi-SPROG 3 v2 and Pi-SPROG 3 Plus unless stated otherwise.

The SPROG 3 Plus and Pi-SPROG 3 Plus have two track outputs. With the supplied 5A power supply each output can supply up to 2.5A to the layout

The Pi-SPROG 3 v2 is the replacement for the Pi-SPROG 3 which was, in turn, a replacement (via firmware upgrade) for the Pi-SPROG One, and has a single track output that can be used in programmer or command station modes supplying up to 2.5A to the layout. It is not possible to upgrade from Pi-SPROG One or Pi-SPROG 3 to Pi-SPROG 3 v2, other than by purchasing the new hardware.

Features

- The SPROG 3 plus has an isolated USB interface to protect the host computer
- The Pi-SPROG 3 Plus has an isolated CAN interface
- Flexible operating modes (Plus models only)
  - One layout power district and one service mode programmer output
  - Two layout power districts, one with auto switching to service mode programming track
  - Two layout power districts, one with auto-reverse
- Flexible operating modes (v2)
  - Programmer mode supporting service mode programming and test running of locos on a programming track
  - Command station mode for full layout control

- Programs virtually ***all*** NMRA compliant DCC decoders
- No extra hardware required for programming sound decoders (e.g. programming booster) – but does not allow loading of sound projects.
- Easy to use graphical interface with DecoderPro

Requirements

- JMRI from http://jmri.sourceforge.net/
- PI-SPROG 3 v2/Plus requirements:
  - Raspberry-Pi (R-Pi 4 model B recommended)
  - Raspbian OS image for the Pi-SPROG 3 plus
    - See the image creation instructions on our website
    - A suitable image may be purchased on micro SD card at the same time as the Pi-SPROG 3 v2/Plus.
    - No drivers are required
- SPROG 3 Plus requirements:
  - FTDI VCP Windows USB drivers from https://ftdichip.com/drivers/vcp-drivers/ for the SPROG 3 Plus
  - No drivers are required for popular Linux distributions

Specification – Layout Power Districts

Parameter	Minimum	Nominal	Maximum	Units	Note
DC Input supply voltage	12V		25V	V	1
Vin supply current – idle		50		mA	
Vin supply current – Operating Layout			5 2.5	A	2 3
Operating Temperature Range		25		°C	
Output Load – Operating Layout			2.5	A	4

Table 1 Specification/Operating Conditions

Notes:

1. The track voltage will be fractionally lower than the power supply input voltage.
2. Total for both outputs SPROG 3 Plus and Pi-SPROG 3 Plus
3. Pi-SPROG 3 v2
4. Per output. The combined output current limits must always be set lower than the power supply capability.

Specification – Service Mode Programming

Parameter	Minimum	Nominal	Maximum	Units	Note
Vin supply current – programming		300		mA	5
Output Load - programming			250	mA	5

Table 2 Specification/Operating Conditions

Notes:

5. SPROG 3 Plus will remove track power if output current exceeds 250mA as measured 100ms after applying power. Surge current during decoder power-up may be considerably greater than this, but is allowed for.

Software Installation

The following steps are required to install the SPROG 3 Plus before you can use it for the first time:

- Install FTDTI USB drivers (Windows only)
- Install DecoderPro 4.21.3 or later
- Edit DecoderPro preferences
- Connect the Power Supply
- Connect to the layout
- (Optional) Connect to CBUS

Install DecoderPro

DecoderPro should be installed from the USB key (if purchased with the SPROG 3 Plus) or a downloaded copy.

A newer version of DecoderPro than that supplied on the USB key may be available from the JMRI download page http://jmri.sourceforge.net/download

This user guide assumes you are using version 4.21.3, or later.

To install from the USB key, browse to the directory specific to your operating system to find the JMRI installer. For example, if your USB key drive is D: on Windows, double click on the file D:\Windows\JMRI.4.21.3.exe.

This document gives brief installation instructions for the Windows 10 Operating System. For further instructions and for instructions to install DecoderPro on Linux, please refer to the Install Guides on the JMRI website at http://jmri.sourceforge.net/download

Hardware Details

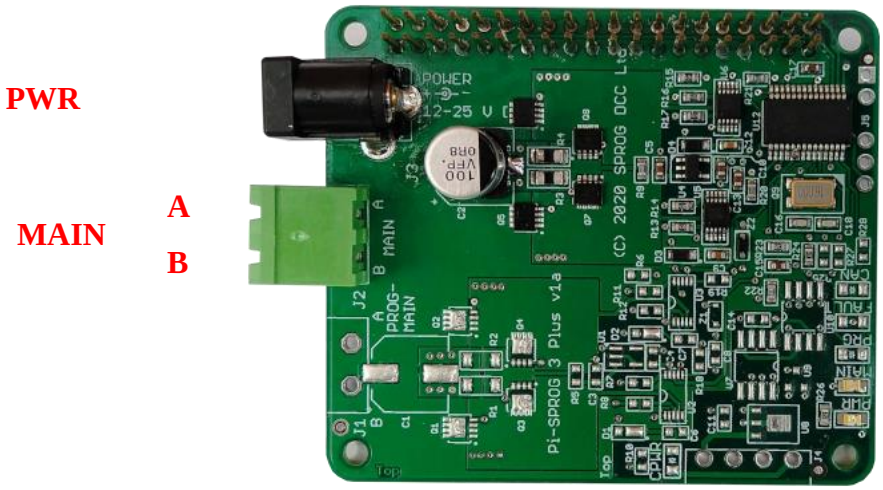
Connect the Power Supply

The supplied power supply has a standard DC barrel connector (centre positive), that plugs directly in to the SPROG 3 plus

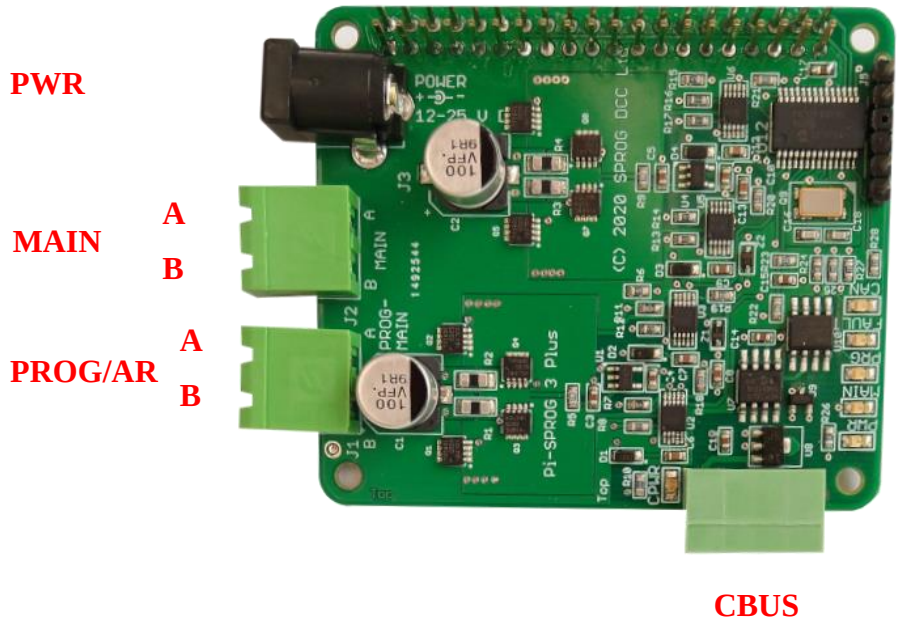
SPROG 3 Plus Front Panel

SPROG 3 Plus Rear Panel

Pi-SPROG 3 v2



Pi-SPROG 3 Plus



PROG/AR output, CBUS interface, and associated components are not present on Pi-SPROG 3 v2.

Connect the Programming Track or Layout

Layout power districts may be connected to both MAIN and PROG/AR track outputs. PROG/AR is the auto-reverse power district.

If using a service mode programming track with SPROG 3 Plus or Pi-SPRG 3

Plus, this must be connected to the PROG/AR output.

Care should be taken with the polarity of the track connections, e.g., maintain A to left rail, B to right rail, or vice-versa, throughout the layout.

For all but the smallest layouts you should use a substantial power bus around the layout with short, thinner “droppers” to individual track segments. Avoid relying on rail joiners for conducting power around the layout.

Connect the CBUS (Optional) – Plus Models Only

CBUS requires at least a 3-way connection for proper operation. CAN HI, CAN LO and 0V.

In the SPROG 3 Plus the CAN transceiver is internally powered.

In the Pi-SPROG 3 plus, then CAN interface is galvanically isolated and 12V power must be applies to the CBUS connector.

The CBUS must be correctly terminated for proper operation. For very small installations a single 60 ohm resistor is often sufficient. For larger installations a 120 ohm resistor should be connected across CAN HI and LO at each end of the bus.

SPROG 3 Plus Status LEDs

USB Interface

USB reception (Rx) is indicated by a brief flash of the USB Rx LED.

USB transmission (Tx) is indicated by a brief flash of the USB Tx LED

Layout Interface

Input power is indicated by the red PWR LED.

The track activity is indicated by the MAIN and PROG/AR red LEDs, which will illuminate steadily when their respective outputs are powered up.

When the PROG/AR output is being used for a programming track, the PROG/AR LED will flash slowly when power is applied during a programming operation.

A fast flash on the MAIN or PROG/AR LEDs indicates an overload condition.

When the module starts up (e.g., after applying power) all three LEDs will illuminate. The PROG/AR and MAIN LEDs will extinguish at 0.5 second intervals. The PWR LED will remain illuminated whilst power is applied.

CBUS Interface

The CBUS interface status is indicated with two red LEDs.

The CBUS activity, ACT, LED indicates CBUS frame transmission and reception.

The CBUS FAULT LED indicates a fault on the CBUS interface.

Both ACT and FAULT LEDs are illuminated when the module starts up.

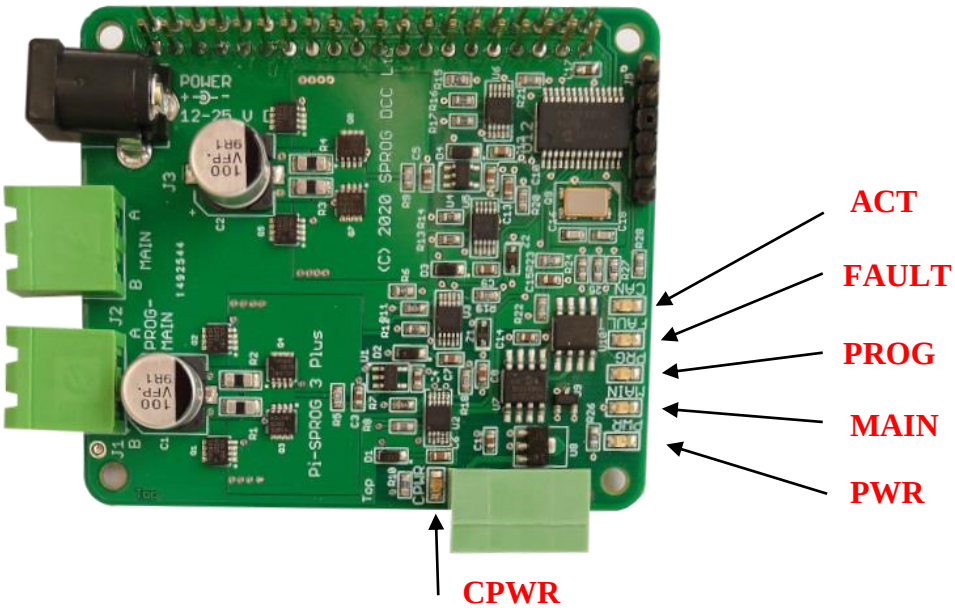
The ACT LED will extinguish on the first CBUS frame and then flash for each subsequent CBUS frame.

The FAULT LED will extinguish on the first CBUS frame and then illuminate if there is a fault on the CBUS interface.

Unused LED

There is one unused LED (in the firmware covered by this UserGuide). This LED remain illuminated during operation.

PI-SPROG 3 Plus Status LEDs



Layout Interface

Input power is indicated by the red PWR LED.

The track activity is indicated by the MAIN and PROG/AR red LEDs, which will illuminate steadily when their respective outputs are powered up.

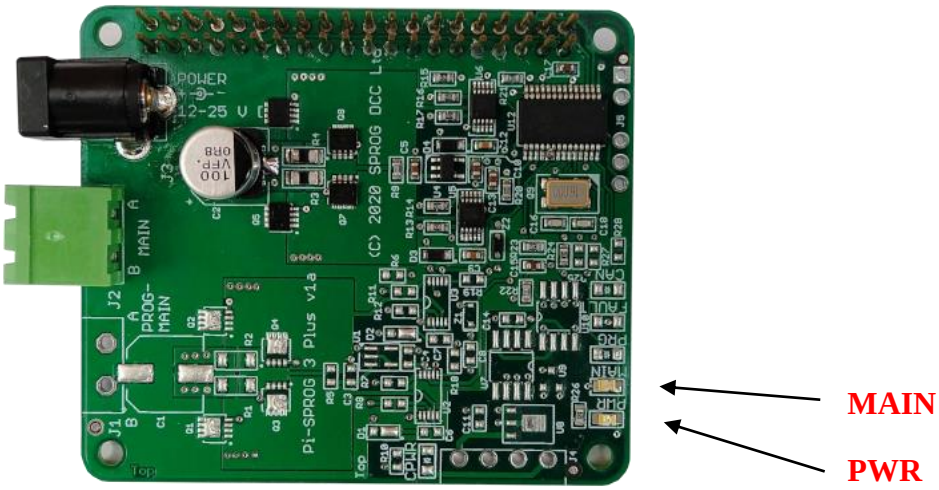
When the PROG/AR output is being used for a programming track, the PROG/AR LED will flash slowly when power is applied during a programming operation.

A fast flash on the MAIN or PROG/AR LEDs indicates an overload condition.

When the module starts up (e.g., after applying power) all three LEDs will illuminate. The PROG/AR and MAIN LEDs will extinguish at 0.5 second intervals. The PWR LED will remain illuminated whilst power is applied.

The MAIN and PROG/MAIN LEDs will flash together and the if power is not connected.

PI-SPROG 3 v2 Status LEDs



Layout Interface

Input power is indicated by the red PWR LED.

The track activity is indicated by the MAIN LED, which will illuminate steadily when the output is powered up.

The MAIN LED will flash slowly when power is applied during a service mode (programming track) programming operation.

A fast flash on the MAIN LED indicates an overload condition.

The MAIN LED will flash if Power is not connected.

CBUS Interface

The CBUS interface status is indicated with three red LEDs.

The CBUS activity, ACT, LED indicates CBUS frame transmission and reception.

The CBUS FAULT LED indicates a fault on the CBUS interface.

Both ACT and FAULT LEDs are illuminated when the module starts up.

The ACT LED will extinguish on the first CBUS frame and then flash for each subsequent CBUS frame.

The FAULT LED will extinguish on the first CBUS frame and then illuminate if there is a fault on the CBUS interface.

The CBUS power, CPWR, LED indicates the presence of power on the CBUS connection.

SPROG 3 Plus Initial Setup Using Terminal Interface (Optional)

The SPROG DCC Generation 5 Interface

The SPROG 3 Plus is a SPROG Generation 5 products. The interface between the host and the SPROG 3 Plus is CBUS, using the GridConnect protocol The Plus models may also be connected to a CBUS network but this is not required to operate run trains and operate DCC accessories on a layout.

The SPROG 3 Plus also supports an additional command set that may be access through a terminal emulator program such as PuTTY https://www.chiark.greenend.org.uk/~sgtatham/putty/ This can be used for module setup and CBUS testing.

The SPROG 3 Plus includes a bootloader that allows firmware updates to be installed by the user.

JMRI must not be connected to the SPROG 3 Plus when using the terminal interface.

Use a terminal emulator program set to 460800 baud, 8 bits, no parity, 1 stop bit to connect to the SPROG.

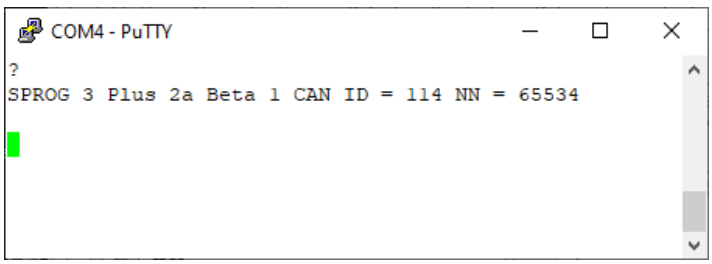
Commands may be typed in upper or lower case. All numeric entry is assumed to be decimal. All commands should be followed by a carriage return.

The SPROG 3 Plus does not echo characters back to the terminal. Local echo can be enabled in the PuTTY Terminal options to show what you have typed.

The SPROG 3 Plus does not allow backspace to be used.

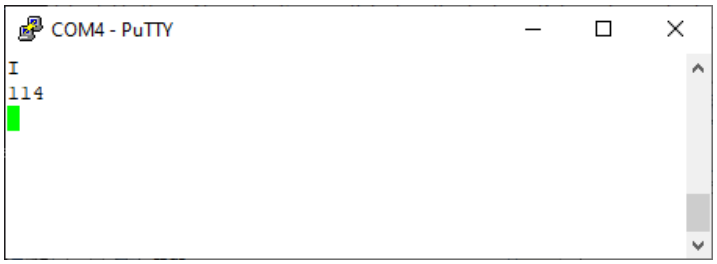
Checking the Firmware Version

Use the ? command to check the firmware version. This will also display the current CAN ID and CBUS Node Number

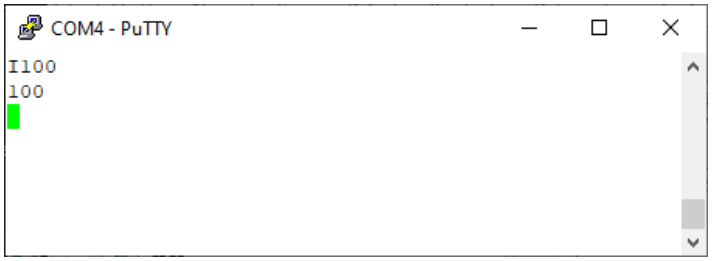


Setting the CAN ID

The I command will show the current CAN ID.



A new ID may be set by following the I command with a number in the range 1 – 127. The new ID will be displayed. The old ID will be displayed if the new value is invalid.



It is recommended that modules such as the SPROG 3 Plus, with a fixed CAN ID, have a CAN ID in the range 100 – 127.

Any CBUS traffic from JMRI will use the CAN ID assigned in the JMRI connection preferences.

CBUS traffic generated from the SPROG 3 Plus itself will use the SPROG 3's own CAN ID which is 114 in a new module.

All modules must have a unique CAN ID.

Setting the Node Number

The N command will show the current Node Number.

A new NN may be set by following the I command with a number in the range 1 – 65535. The new NN will be displayed. The old NN will be displayed if the new value is invalid.

The SPROG 3 Plus Node number is 65534 in a new module.

It is recommended, but not required for more advanced users, that all modules have a unique Node Number when using CBUS.

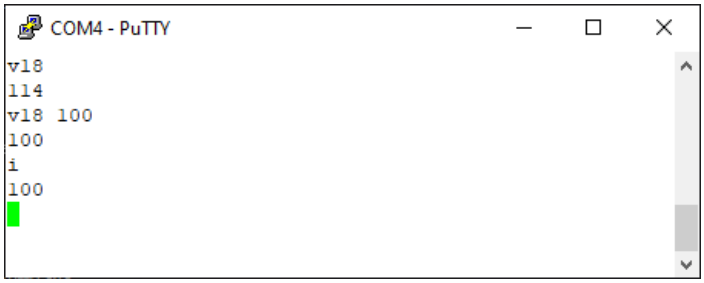
It is recommended that modules such as the SPROG 3 Plus, with a fixed NN, have an NN in the range 65520 - 65535.

Changing Node Variables (NVs)

The V command will show the current value of an NV.

A new value may be written to an NV by giving the value in the range 1 – 255. The new NV value will be displayed. The old NV value will be displayed if the new value is invalid.

The example shows setting the CAN ID through NV18.



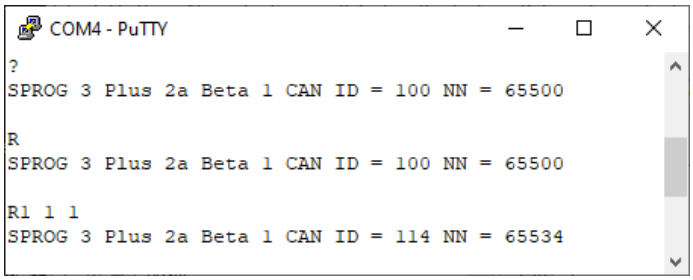
Take care to understand what you are doing when changing NVs.

See CBUS Node Variables in SPROG 3 Plus for the NVs supported by the Pi-SPROG 3 Plus

Reset SPROG 3 Plus to Factory Defaults

The R command will reset the CANISB to the factory default, notably the CAN ID and Node Number. The output is similar to the ? command, showing the firmware version, ID and NN.

To prevent inadvertent resets, the R command must be followed by 3 parameters of any value between 0 and 65535. In the following example, R with no parameters has no effect.



The R command DOES NOT revert to the original firmware version, if updates have been applied.

Getting Started with JMRI (DecoderPro and PanelPro)

DecoderPro and PanelPro are different interfaces to the same underlying JMRI software. The split exists for historical reasons only. There are some differences in the functions that are available from the menus but a lot of features are available through both interfaces.

It has become customary to think of DecoderPro as the tool for programming decoders and PanelPro for controlling a layout.

DecoderPro will often be used with a dedicated programming track for 'service mode' programming. This allows full read and write access to all Configuration Variables (CVs) in a ***single*** decoder.

PanelPro will often be used with 'on the main' or 'ops mode' programming in conjunction with layout control. In this mode CVs may be written, but (without special hardware such as Railcom) values cannot be read back. The SPROG 3 Plus does not support reading from decoder in ops mode. The advantage of ops mode programming is that any loco, out of all the locos on a layout, may be programmed. Unlike service mode there is no single loco limit.

We will use that distinction (DecoderPro for service mode programming and PanelPro for ops mode programming) in discussing the use of the SPROG 3 Plus.

Despite this, the current SPROG 3 Plus firmware, unlike earlier SPROG DCC products, makes little distinction between programming and operating.

! Care should be taken when using the service mode programmer that the programming track is isolated from the layout.

With the SPROG 3 Plus and the Pi-SPROG 3 Plus, use the Mode Switch tool to select either 'Programming track off when not programming' (recommended for new users) or 'Programming track follows main when not programming' to use a service mode programming track.

Setting the JMRI Connection Preferences

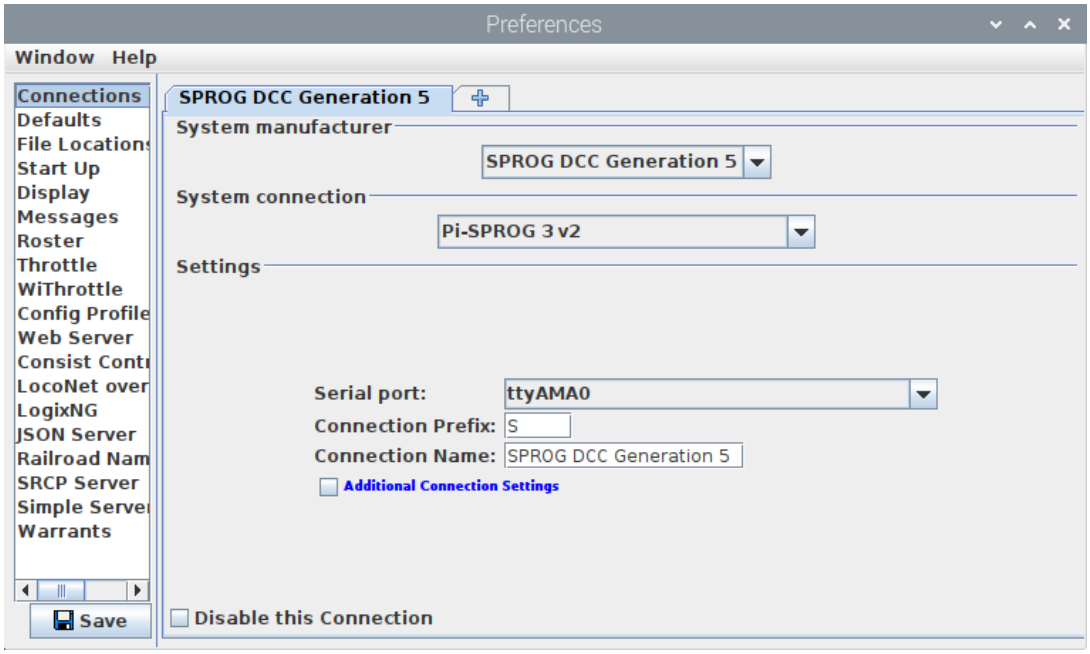
If creating your own system then please be sure to select SPROG DCC Generation 5 (**NOT** simply SPROG DCC) as the System Manufacturer and the appropriate System Connection in the connection preferences for DecoderPro or PanelPro.

On Windows systems, the COM port required for the Serial port entry may be determined by looking for the SPROG 3 Plus in the Windows Device

Manager under Ports “COM & LPT”. The SPROG 3 Plus will appear as a USB Serial port.

On Linux the SPROG 3 Plus USB interface should be created as ttyUSBx when x will depend on what other hardware is connected to the system.

For the Pi-SPROG 3 Plus, Pi-SPROG 3 v2 and Raspbian, if you have followed our recommended image creation, select the ttyAMA0 serial port.



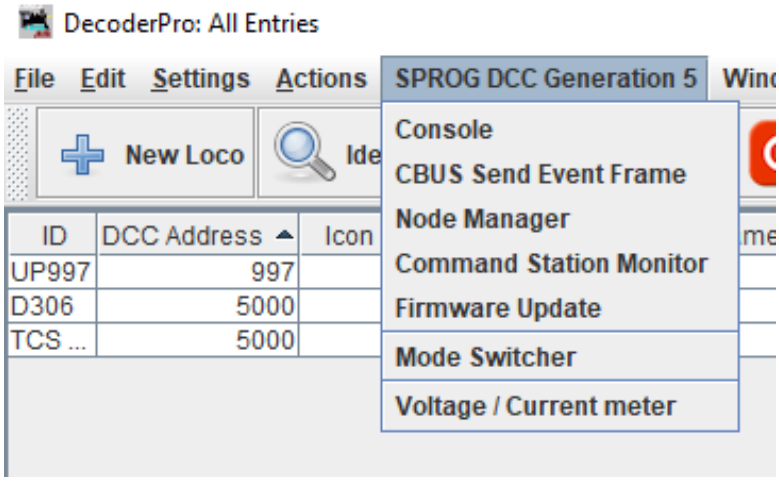
Further details are beyond the scope of this document.

Please see the “Getting Started with DecoderPro and PanelPro” document on our website or consult the JMRI on-line help pages.

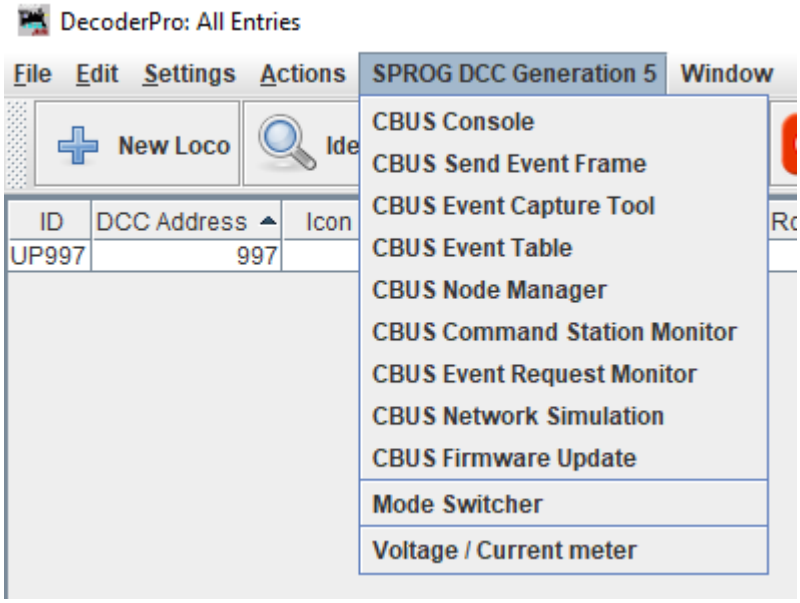
SPROG DCC Generation 5 JMRI Tools

A number of tools are available on the SPROG DCC Generation 5 menu.

For the Pi-SPROG 3 v2



For the Pi-SPROG 3 Plus and SPROG 3 Plus

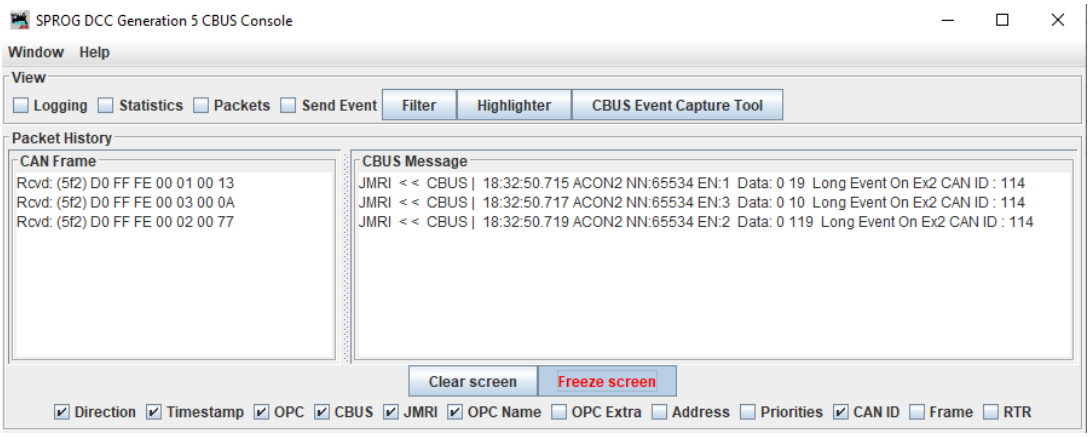


A selection of these are descibed in more detail below. The Firmwware Update Tool is described in a later section.

Console

The console shows the CBUS frames sent to/from SPROG 3 Plus and the host. It is useful for capturing diagnostic information if a problem occurs that is repeatable.

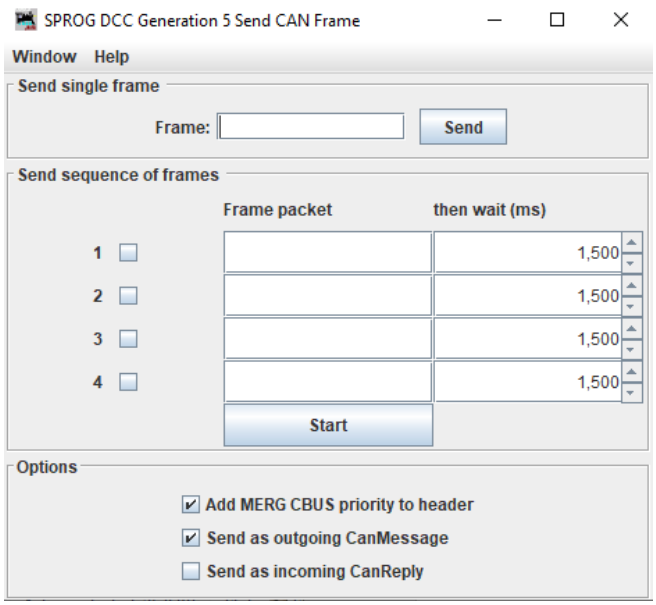
Various display options re selectable and the output may be logged to a file.



CBUS Send Event Frame

The send event frame tool allows CBUS events to be sent manually, e.g., for testing or setting up.

On the Pi-SPROG 3 v2 (that has no CAN interface) events wil always be translated into DCC accessory commands using the Event Number as the DCC accessory address.

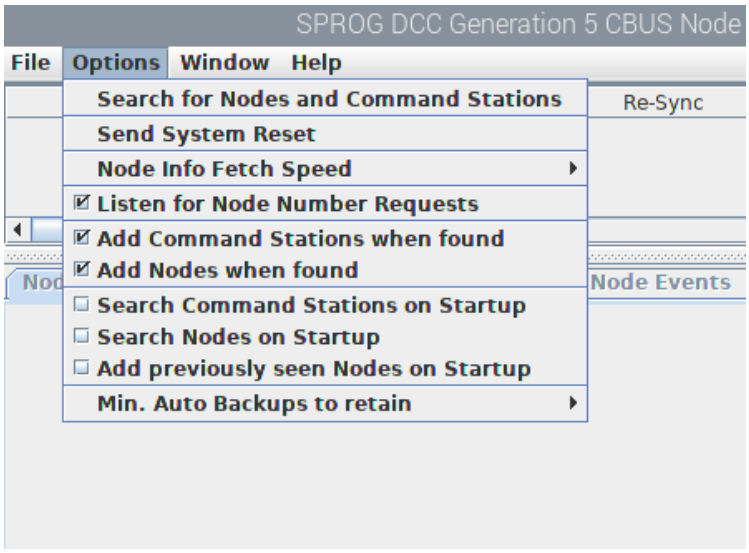


Node Manager

The node Manager allows access to internal settings in the SPROG 3 Plus. It is not required for normal, everyday, operation, unless you need to change some aspect of the SPROG 3 Plus operation (Older SPROG users may think of this as being similar to setting the SPROG mode word).

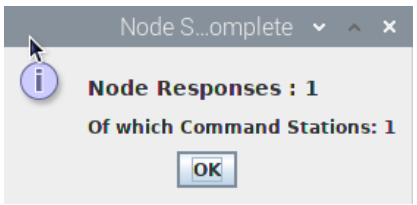
The node manager is started from the SPROG DCC Generation 5 > Node Manager menu item.

Select the option ‘Add Command Stations when found’ and ‘Add Nodes when found’ in the Options menu.



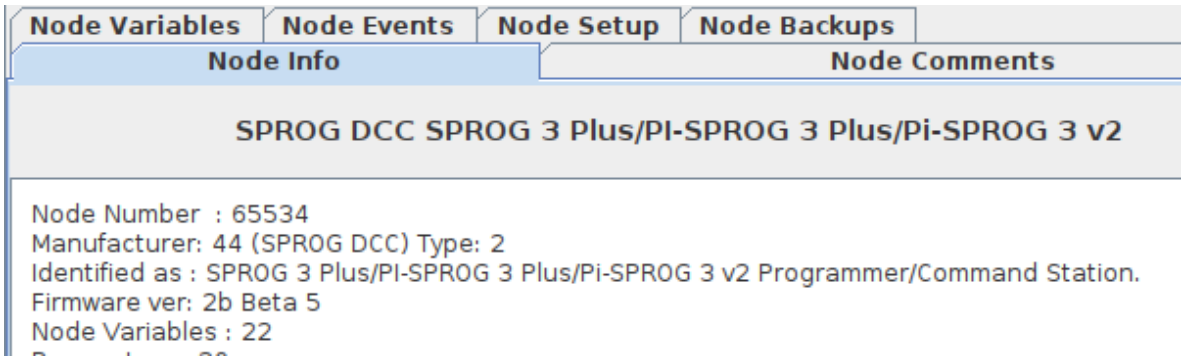
Click ‘Search for Nodes and Command Stations’ in the Options menu

The SPROG 3 Plus should respond as a Command Station

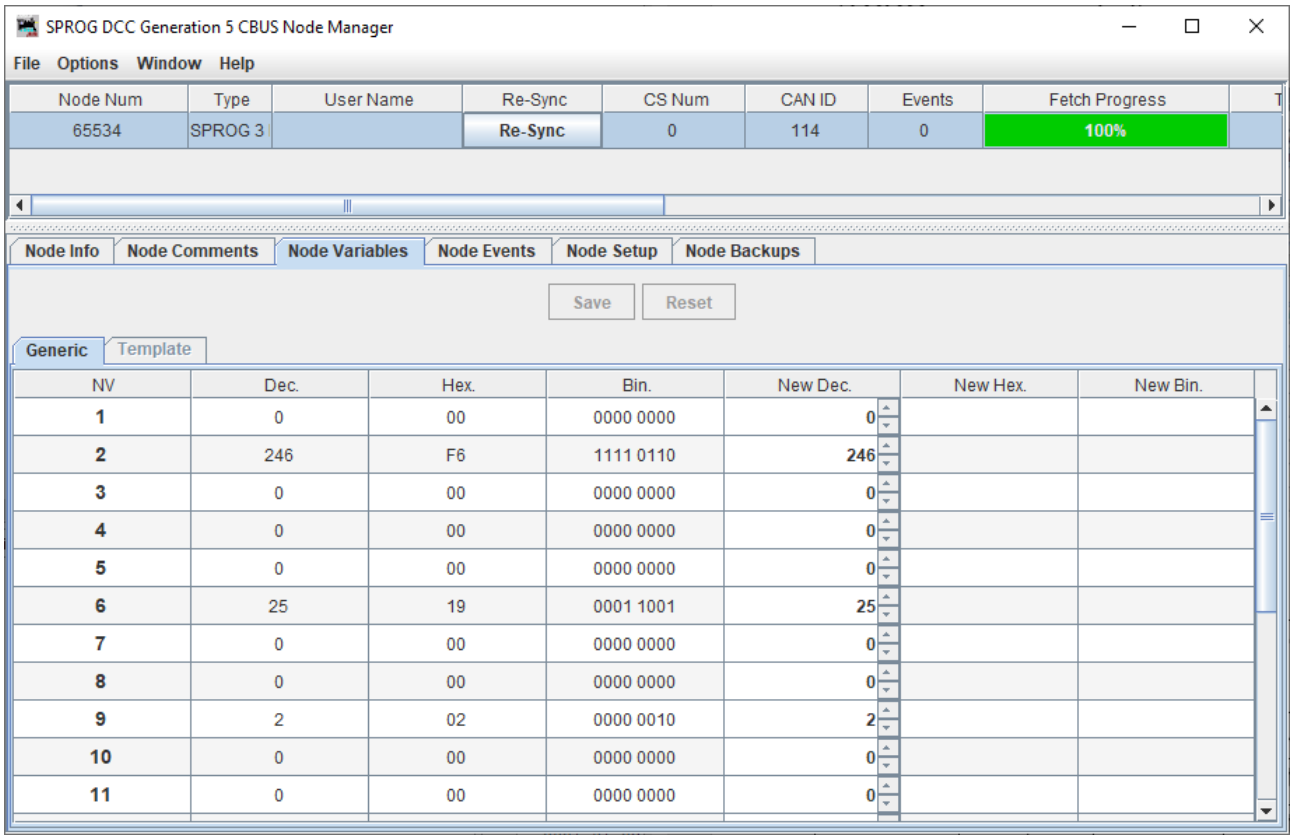


Click OK.

In the Node Info tab you can see details such as the firmware version of the SPROG 3 Plus



The Node Variables (NVs) control the operation and show the internal status of the SPROG 3 Plus, much like the CVs in a DCC decoder.



To change an NV use the spinner to select the new value, or type the new value directly, click the save button and then confirm the operation in the pop up dialog.

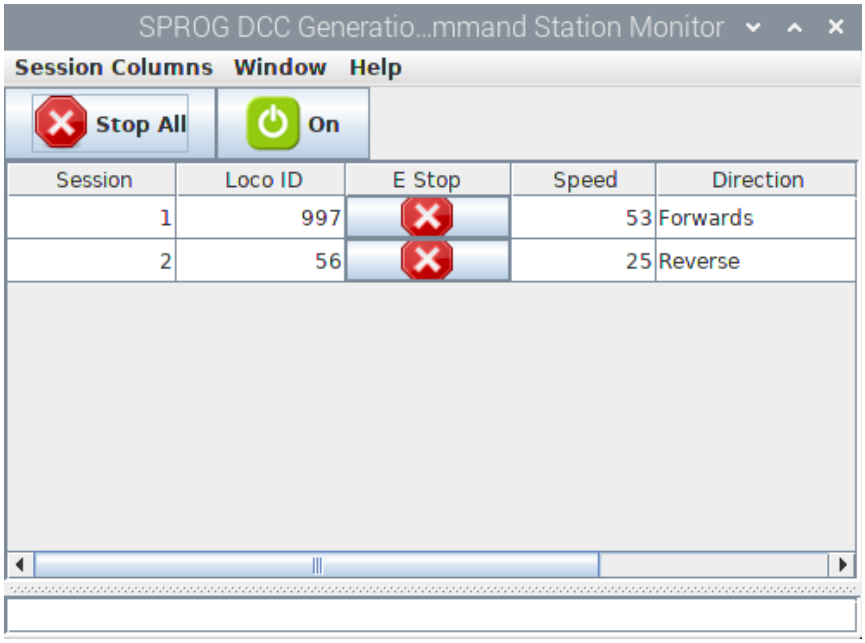
Take care to understand what you are doing when changing NVs.

Not all NVs are supported on all hardware variants. See CBUS Node Variables in SPROG 3 Plus

Command Station Monitor

When using the SPROG 3 Plus as a command station controlling multiple locos, you can see the status of all locos in the command station monitor.

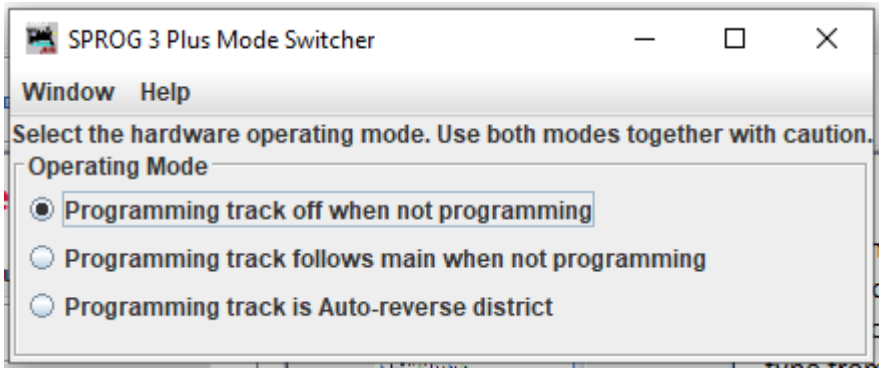
Emergency stop and power control buttons are also provided in the command station monitor window.



Mode Switching with SPROG 3 Plus and Pi-SPROG 3 Plus

The mode switcher controls the operating mode of the programming track output.

With the SPROG 3 Plus and Pi-SPROG 3 Plus, three operating modes are available.



Programming Track Off When Not Programming

In this mode the programming track output supports service mode programming and is turned off when not programming. This mode would typically be used where the programming track is close to, but not connected to, the main layout. Locos to be programmed would be lifted from the layout and placed on the programming track.

Layout operation may continue whilst programming.

Programming Track Follows Main When Not Programming

In this mode the programming track output supports service mode programming and is linked internally to the main track output. When not programming, the programming track output will follow the main track output, e.g., to allow locos to be driven from the main layout to a spur or siding being used as a programming track.

Care must be taken that nothing bridges between the programming track and the main layout when programming starts.

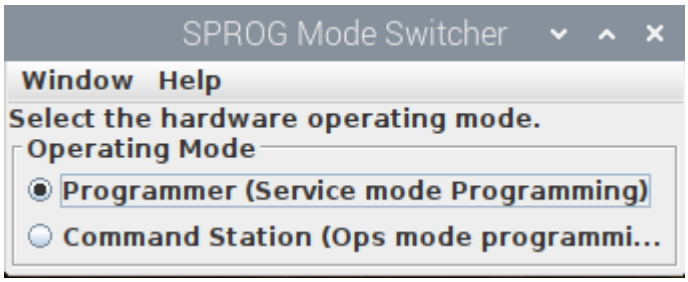
Layout operation may continue whilst programming.

Programming Track is Auto-reverse District

In this mode the programming track output does not support service mode programming. Instead, it can be used as a second layout power district with auto-reverse.

Mode Switching with Pi-SPROG 3 v2

With the Pi-SPROG 3 v2, only two operating modes are available.



Always close and reopen any programmer windows when switching modes to ensure they reflect the programming modes.

Programmer (Service mode programming)

In this mode the track output support service mode programming on a programming track with full read and write access to CVs. A single throttle can be used for test running. Care must be taken not to use this mode when connected to a layout as all locos on the layout will be reprogrammed.

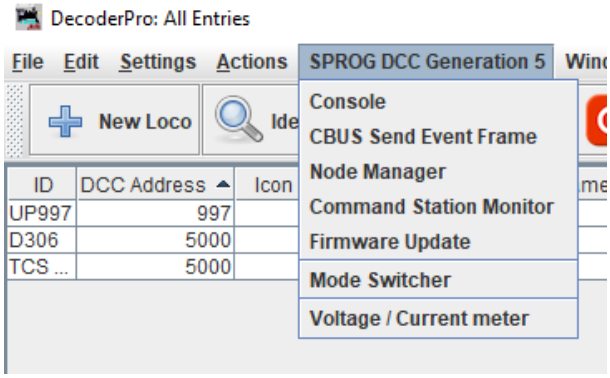
Command Station (Ops mode programming)

In this mode the programming track support Operations mode or on the main programming and multiple throttles for layout control.

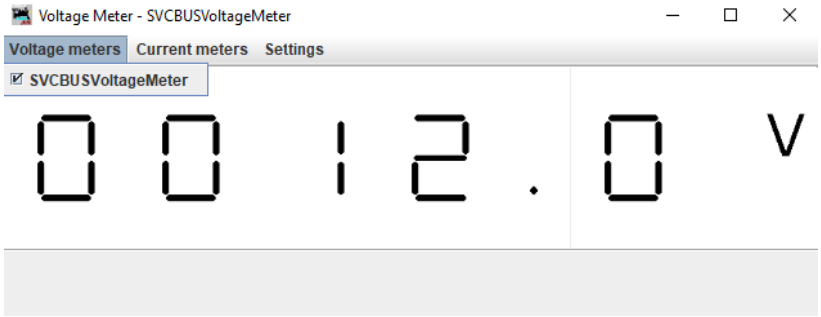
Voltage/Current Meter

If Node Variable 10, Multimeter Mode, is set to 1 then the SPROG 3 Plus will send regular voltage and current measurements (approx. every 2s) to the host and to CBUS. These may be displayed with JMRI Voltage/Current meters.

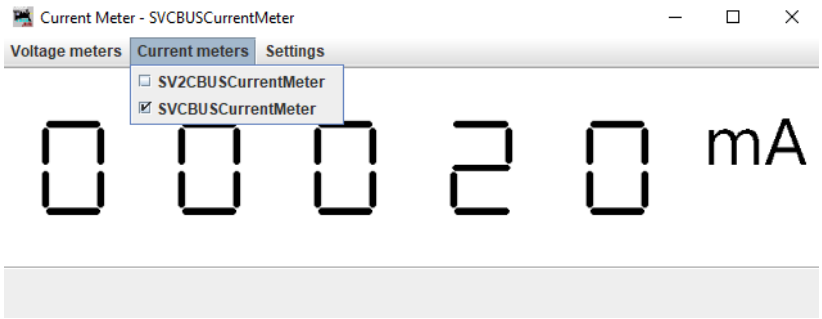
Open a meter from the SPROG DCC Generation 5 menu



Set the meter to be a voltage or current meter



The voltage meter monitors the input supply voltage. The DCC track voltage will be slight less than this.



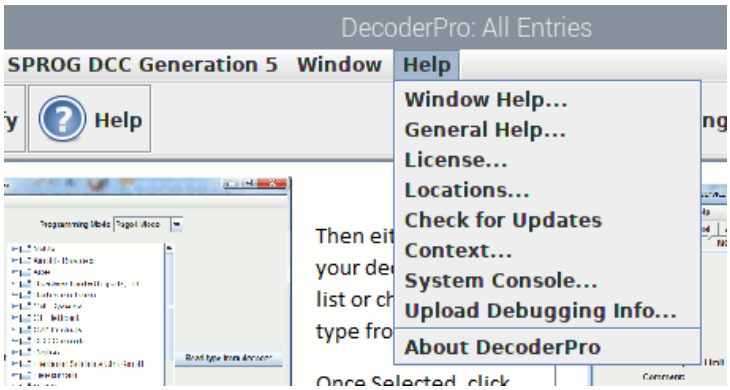
The SVCBUSCurrentMeter displays the main track current.

The SV2CBUSCurrentMeter displays the programming track current.

The voltage and current measurements are for information only and accurate to +/-5%. The current readings, especially, may fluctuate to a marked extent.

The JMRI System console

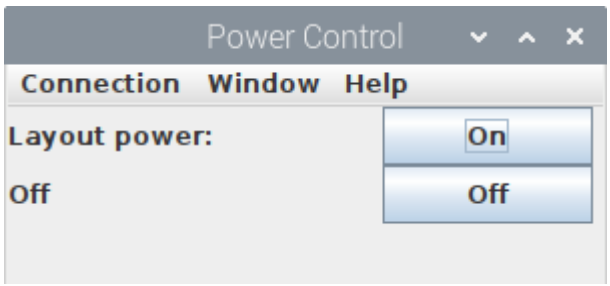
The JMRI system console can be opened from the Help > System console menu item.



The system console contents may be useful when something goes wrong. Look for ERROR or WARNING messages.

The JMRI Power Manager

The state of the track power can be controlled through the Power Control.



Or by clicking the icon that appears in various windows, e.g., throttles

During programming the prog track power will be controlled automatically but will not be reflected in the power manager.

By default, the power is always off at startup. This behaviour can be changed by setting the User Flags Auto power bit. The hardware will broadcast the power state during startup.

For all Pi-SPROGs, the initial power state will show as Unknown in JMRI as

the hardware starts up before the software and the broadcast message is not seen.

For the SPROG 3 Plus the initial power state displayed by JMRI will depend whether the hardware or software starts up first. If JMRI is started before power is connected to the SPROG 3 Plus then the power state will reflect the Auto Power setting, once the hardware startup is complete.

Introduction to CBUS

<TODO>

This section does not apply to the Pi-SPROG 3 v2.

CBUS operation has had only basic testing in this release. Some features may not operate as expected.

SPROG 3 Plus Operation with CBUS Cabs (Throttles)

This section does not apply to the Pi-SPROG 3 v2.

Steal/Share

<TODO>

CBUS Node Variables in SPROG 3 Plus

The Node Variables (NVs) control the operation and show the internal status of the SPROG 3 Plus, much like the CVs in a DCC decoder.

NVs may be changed through the terminal interface or through the JMRI node manager.

At the time of writing, the SPROG 3 Plus is not supported by the FCU (a configuration tool written and supported by MERG members).

A subs-set of the NVs are available on the Pi-SPROG 3 v2.These are indicated by an X in the V3 column in the following table.

Node Variable	Values	Default	V2	Function
1	0	0	X	Command station number
2	0 – 255	246	X	User flags
3	0 – 255	0	X	Operation flags
4	0	0	X	Debug flags – not currently used
5	0,1,2	0	X	Programming track power mode
6	0 – 255	25	X	Programming track current limit, Amps x 10
7	0 – 255	-		Read only input voltage, Volts x 10, e.g. 118 represents 11.8 V
8	0 - 255	-		Read only main track current, Amps x 10
9	1 – 7	1		Accessory packet repeat count.
10	0,1	0		Multimeter mode. Set to 1 to enable voltage and current events.
11	0 – 255	0		NN to map to DCC hi byte
12	0 – 255	0		NN to map to DCC lo byte
13	0 – 255	25		Main track current limit, Amps x 10
14	0 – 255	-	X	Read only programming track current, Amps x 10
15	0 – 255	-		Read only main track current high-water mark, in Amps x 10
16	0 – 255	-	X	Read only programming track current high-water mark, Amps x 10
17	0,1	0		Setup mode – do not use
18	1 – 127	114		CAN ID

19	0 – 255	255	X	Node Number high byte
20	0 – 255	254	X	Node Number low byte
21	16 - 255	16	X	Number of DCC preamble bits transmitted
22	0, 1	0		CAN disable

NV1 Command Station Number

Only command station 0 is currently supported. Any other values will be ignored.

NV2 User Flags

The user flags NV contains 8 bits.

The default value is 01110110 or hex 76 or decimal 118.

Reserved bits should always be set to 0 and will read as zero.

Bit	Default	Function
0	0	Reserved
1	1	Permit Steal: Set to enable steal option
2	1	Permit Share: Set to permit share option
3	0	Reserved
4	1	Map Events: Set to map CBUS events directly to DCC accessory packets
5	1	Stop on Timeout: If set and a loco session times out, the train is brought to a stop. If clear the train is dispatched whilst moving
6	1	Start of Day: Set to send CBUS even 0 on startup which may be used as a start of day event
7	0	Auto Power: Set to turn track power on at startup

NV3 Operation Flags

The operation flags NV contains 8 bits.

The default value is 0.

Reserved bits should always be set to 0 and will read as zero.

Bit	Default	Function
0	0	Reserved
1	0	Reserved
2	0	Reserved
3	0	ZTC Mode: Set to modify bit timing when programming for ZTC decoders
4	0	All stop track off: Set to turn track power off if an all stop command is issued
5	0	Blueline Mode: Modify programming operation to suit blueline decoders
6	0	ACK sensitivity: Set to modify programming ACK pulse detection for certain large scale Zimo decoders
7	0	Reserved

NV4 Debug Flags

Debug flags NV is currently reserved. All bits will read as zero.

NV5 Programming Track Power Mode

The way the programming track works is controlled by Node Variable 5 and can have one of three values

SPROG 3 Plus and Pi-SPROG 3 Plus

NV5	Mode
0	**Programming Track Off When Not Programming** Programming track is independent of main track and is off when not programming
1	**Programming Track Follows Main When Not Programming** Programming track follows main track when not programming
2	**Programming Track is Auto-reverse District** Programming track follows main track Auto reverse on overload

Pi-SPROG 3 v2

NV5	Mode
0	**Programmer Mode** Service mode programming packets will be generated for use with a programming track
1	**Command Station Mode** Operations mode programming packets will be generated for “ops-mode” or “on the main” programming

NV6 Programming Track Current Limit

NV13 Main Track Current Limit

Current trip limits to be applied to the two track outputs in Amps x 10, e.g., a value of 20 will apply a current limit of 2.0A.

NV7 Input Voltage

Measured input supply voltage in Volts x 10, e.g., 125 represents 12.5V.

NV8 Main Track Current

NV14 Programming Track Current

Current measurement in Amps x 10, e.g., 7 represents 0.7A or 700mA.

NV9 DCC Accessory Packet Repeat Count

Range 1 – 7.

The number of times a DCC accessory packet is repeated. If DCC accessories do not operate reliably, try increasing the repeat count by 1.

NV10 Multimeter Mode

0 – Multimeter events disabled

1 – Multimeter current/voltage measurement events enabled

NV11, NV12 Node Number to Map to DCC

Set to zero to map all short events directly to DCC accessory commands where the event number becomes the DCC accessory number.

Set a non-zero value to match a specific node number and map all long events from that node to DCC accessory commands.

NV15 Main Track Current High-Water Mark

NV16 Programming Track Current High-Water Mark

The current high-water marks store the highest measured current as Amps x 10 (e.g., a value of 13 represents 1.3 Amps).

The high-water marks can be reset by writing 0 to the appropriate NV.

NV17 Setup Mode

<TODO>

NV18 CAN ID

It is recommended that modules such as the SPROG 3 Plus, with a fixed CAN ID, have a CAN ID in the range 100 – 127.

NV19, NV20 Node Number

Range: 0 – 255.

High and low byte, respectively of the CBUS node number. Overall range is 0 – 65535.

NV21 DCC Preamble Bits

The number of preamble bits sent before each DCC packet.

NV22 CAN Disable

0 – CAN bus is enabled (normal operation).

1 – CAB bus is disabled (for test purposes).

Voltage and current measurements are for information only and accurate to +/-5%.

CBUS Opcodes Supported by the SPROG 3 Plus

Opcodes Interpreted as Commands

<TODO>

This section does not apply to the Pi-SPROG 3 v2.

CBUS Opcode (OPC)			
ARST	System Reset		

Opcodes Output as Results

<TODO>

This section does not apply to the Pi-SPROG 3 v2.

CBUS Opcode (OPC)		Comment
ARST	System Reset	Start up
TON	Track On	Startup and Response to RTON
TOF	Track Off	Startup and Response to RTOF
STAT	Status	Startup and track overcurrent error

CBUS Events Supported by the SPROG 3 Plus

Events consumed by the SPROG 3 Plus

None, currently.

Events produced by the SPROG 3 Plus

<TODO>

This section does not apply to the Pi-SPROG 3 v2.

CBUS Opcode (OPC)	Event EV	V2	Data
ACON2	1	X	Main track current sample, mA
ACON2	2		Supply voltage, V*10
ACON2	3	X	Programming track current sample, mA
	0	X	Start of Day

SPROG 3 Plus Firmware Updates

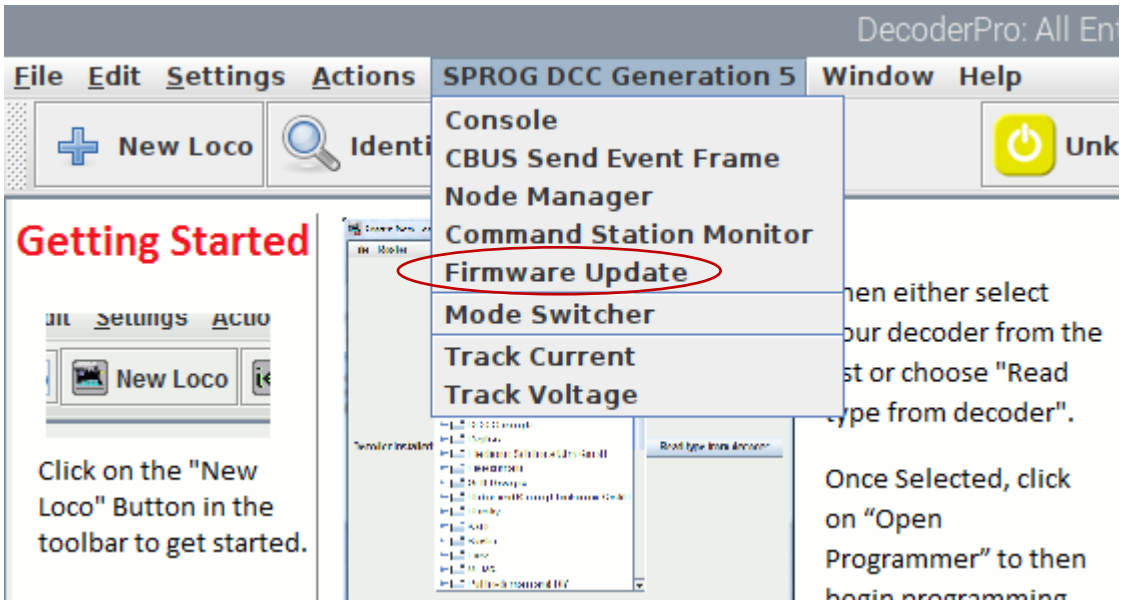
SPROG 3 Plus firmware updates are performed using the Firmware Update tool in JMRI.

Firmware upgrade files (.hex files) will be available from SPROG DCC when an update is available.

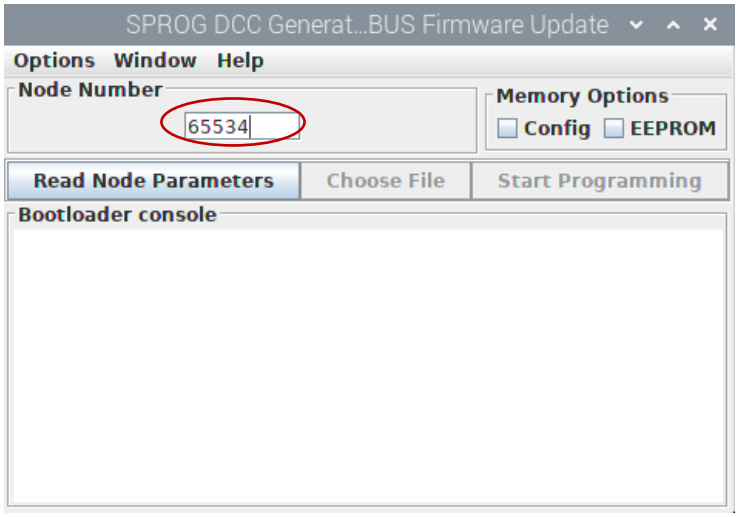
At the time of writing, it is not possible to apply firmware upgrades to the SPROG 3 Plus via CBUS. It is only possible to apply firmware upgrades via USB.

Shut down all throttles (Release or Despatch) and ensure there is no activity on CBUS before using the Firmware Update tool (e.g. disconnect it). Failure to do so may leave the module "bricked" requiring a return to the manufacturer.

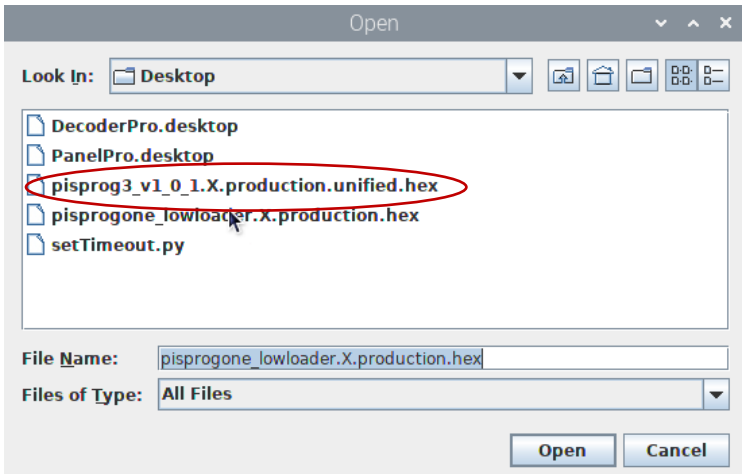
Start the Firmware Update Tool from the SPROG DCC Generation 5 menu in JMRI.



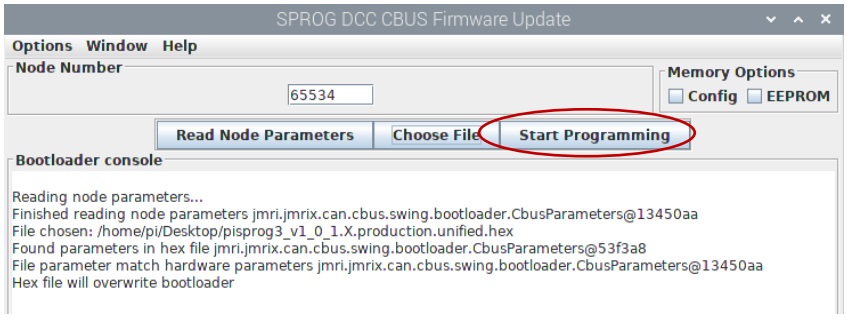
Enter the Node Number (the default is 65534 for the SPROG 3 Plus) and click Read Node Parameters.



If successful, click Choose File and browse to wherever you saved the hex file and click Open



Select EEPROM Memory Option to preserve EEPROM contents (Node Variables) and click Start Programming.



The new SPROG 3 Plus application will be written to the hardware.

Whilst the programming is in progress, the CAN ACT and FAULT LEDs will flash together on a SPROG 3 plus or Pi-SPROG 3 Plus.

Wait for programming to complete (takes a little while).

Firmware Update window will show the completion message

The new firmware is now installed and running.

Known Issues

SPROG DCC Generation 5 are new products and under active development.

Updates will be posted on the io group and company website.

Firmware/JMRI versions listed under Fixed? Column may still be in development or testing and not yet generally available.

Description	Affected Products			Fixed?
	S3P	PS3P	PS3v2	
At startup JMRI power icon may be out of sync with the hardware and will show power on, when it is actually off.	X	X	X	JMRI 4.23.4
Need to cycle track power off/on after changing operating mode with power on	X	X	X	Firmware 2.b.6
Changing pre-amble count is ineffective	X	X	X	Firmware 2.b.6
Operations Flag “All stop track off” does nothing	X	X	X	Firmware 2.b.6
SPROG 3 Plus and Pi-SPROG 3 Plus Only				
PROG LED does not follow PROG track power state when switching modes	X	X	N/A	Firmware 2.b.6
In “Prog track follows main when not programming” mode the loco will try to startup again between programming operations	X	X	N/A	Firmware 2.b.6
Cannot set CANID for messages from JMRI to CBUS	X	X	N/A	JMRI 4.23.5
Full CBUS tools menu not available	X	X	N/A	JMRI 4.23.5
MERG cabs (throttles) are not tested and may not operate as expected	X	X	N/A	
Support for CBUS is still under development and may not function as expected in all situations	X	X	N/A	
No start of day event is sent	X	X	N/A	
Only a single ARST is sent at startup.	X	X	N/A	
Raspberry Pi will struggle to keep up if the CBUS interface is flooded with packets	X	X	N/A	
Pi-SPROG 3 v2 Only				
MAIN LED stays on after programming	N/A	N/A	X	Firmware 2.b.5
PWR LED is not functional on v1a PCBs	N/A	N/A	X	V1b PCB
Pi-SPROG 3 v2 allows multi-throttles in programmer mode. This differs from previous SPROG behaviour.	N/A	N/A	X	
Single CV programmer allows service mode writes in Operations mode. ***These will write to ALL locos on the track.***	N/A	N/A	X	

Troubleshooting

Before reporting any problems, please check the SPROG DCC website for any bug reports or updates.

If you are experiencing intermittent faults with your SPROG 3 Plus, please ensure that you are using a good quality DC, regulated power supply.

Useful Links

SPROG homepage https://www.sprog-dcc.co.uk for the latest information, updates, downloads, etc., for SPROG 3 Plus.

North American distributor for SPROG 3 Plus
http://www.bbmgroup.com/sprog

SPROG DCC discussion group https://groups.io/g/sprog-dcc for latest news and discussion.

FTDI drivers https://ftdichip.com/drivers/vcp-drivers/

Java Model railroad Interface https://www.jmri.org/ for DecoderPro.

JMRI users group https://groups.io/g/jmriusers/topics for latest news and discussion.

Model Electronics Railway Group https://www.merg.org.uk/ for more information about CBUS

PuTTY (terminal emulator)
https://www.chiark.greenend.org.uk/~sgtatham/putty/