

CANSIG – Automatic Signal Control for CBUS systems

The CANSIG firmware provides automatic signal control for MERG CBUS systems. The firmware can drive Semaphore or Multiple Aspect Colour Light signals, and can support multiple events and routing to control each signal aspect.

Each CANSIG module can control up to four signals; these may be two aspect (or semaphore) signals, three aspect signals or four aspect signals.

CANSIG can also support two ‘routed’ signals (Signal 1 and Signal 3) which will have different aspects depending on a ‘route’ setting – this would normally be set from a point position. Routed signals can also display a ‘feather on’ or ‘feather off’ indicator to show the route set.

While the CANSIG firmware uses the common pushbutton and LED sequence for allocation of a node number, it can only be configured in FLiM mode, using the facilities of the FCU or a similar software tool.

CANSIG has six Non-Volatile (NV) parameters that control its operation; these are configured with the MERG FLiM Configuration Utility (FCU) program (V1.4.7.3 or later). The FCU is also used to configure the events used to control the signals.

The software works with the MERG CANACC8 or CANLED64 boards. It will also work with the FLiM IO range of boards.

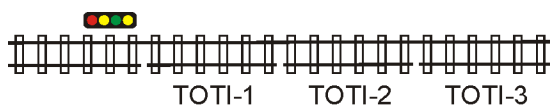
Version History

Version	Date	Change
CANSIG_V2b	22-Apr-13	Fix to 4 x Three Aspect Output Mode Updated NV dialogues for FCU V1.4.7.3
CANSIG_V2a	18-Apr-13	Initial Release

Operation

CANSIG has several different operational modes. Some examples are shown here:

Example 1 – Plain Track, full TOTI Indication.



Configure the events as follows:

- TOTI-1 → Red A On
- TOTI-2 → Yellow A On
- TOTI-3 → D-Yellow A On

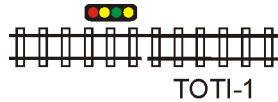
With no trains on the track, the signal will be Green. When the train reaches the TOTI-1 section, the signal will change to Red. When the train reaches the TOTI-2 section, the signal will change to Yellow. When the train reaches the TOTI-3 section, the signal will change to Double-Yellow. When all the TOTI sections indicate clear, the signal will change back to Green.

To manually override the signal to Red using a mimic panel or CANSIG controller, add an additional event:

- SignalRed → Red B On

The signal will then be Red whenever the SignalRed event is on. This can be useful to 'force' a train to wait at a station.

Example 2 – Incomplete TOTI indications



This mode can be used if there are insufficient TOTI sections for full signal aspect control. Configure a single event as follows:

TOTI-1 → Red A On

Also configure *Red-Green Timer Mode* to **10** and *Yellow-Green Timer Mode* to **15**.

With no trains on the track, the signal will be Green. When the train reaches the TOTI-1 section, the signal will change to Red. After it passes this section, the TOTI-1 section will be inactive, and the signal will change to Yellow for 10 seconds, then change to Double-Yellow for a further 15 seconds. Whilst a timer is active, if any events arrive that specifically change the signal aspect, timer mode is automatically cancelled.

Example 3 – Plain Track, multiple TOTI Indications



For some layouts, there may be multiple TOTI detectors for each 'railway block'. Configure the events as follows:

TOTI-1 → Red A On

TOTI-2 → Red B On

TOTI-3 → Yellow A On

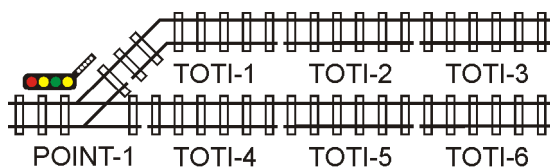
TOTI-4 → Yellow B On

TOTI-5 → D-Yellow A On

TOTI-6 → D-Yellow B On

This example shows how multiple events can be used to control each signal aspect. With no trains on the track, the signal will be Green. When the train reaches the TOTI-1 or TOTI-2 sections, the signal will change to Red. When the train reaches the TOTI-3 or TOTI-4 sections, the signal will change to Yellow. When the train reaches the TOTI-5 or TOTI-6 sections, the signal will change to Double-Yellow. When all TOTI sections indicate clear, the signal will change back to Green.

Example 4 – Simple Junction



This example shows the use of CANSIG with a simple junction. It uses events for both Signal 1 and Signal 2 to control a single signal. Ensure the *Signal 1 Routed* box is checked in the configuration.

Configure the events as follows:

POINT-1 → Signal 1 D-Yellow D/Alt On

TOTI-1 → Signal 2 Red A On

TOTI-2 → Signal 2 Yellow A On

TOTI-3 → Signal 2 D-Yellow A On

- TOTI-4 → Signal 1 Red A On
- TOTI-5 → Signal 1 Yellow A On
- TOTI-6 → Signal 1 D-Yellow A On

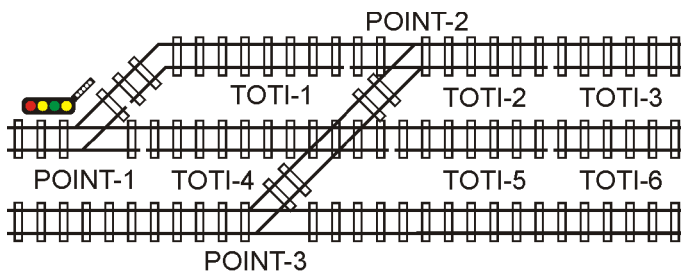
With no trains on the track, the signal will be Green. If the point is set, the feather will light, and TOTI-1, TOTI-2 and TOTI-3 will control the signal aspect. If the point is clear, TOTI-4, TOTI-5 and TOTI-6 will control the signal aspect.

In routed mode, the Signal 2 and/or Signal 4 outputs are used to display feathers or other route indications as follows:

Signal	Signal 2	Signal 4
Red	Signal 1 Routed	Signal 3 Routed
Yellow 1	Signal 1 Routed	Signal 3 Routed
Green	Signal 1 Unrouted	Signal 3 Unrouted
Yellow 2	Signal 1 Unrouted	Signal 3 Unrouted

Note that the Routed/Unrouted indications will not be on with a Red signal unless the *Display route with Red aspect* box is checked in the configuration.

Example 4 – Complex Junction



This example shows the use of CANSIG with a more complicated junction. Configure the events as follows:

- POINT-1 → Signal 1 D-Yellow D/Alt On
- POINT-2 → Signal 1 Red A, Set Signal 2 Red A On
- POINT-3 → Signal 1 Red B, Set Signal 2 Red B On
- TOTI-1 → Signal 2 Red C On
- TOTI-2 → Signal 2 Yellow A On
- TOTI-3 → Signal 2 D-Yellow A On
- TOTI-4 → Signal 1 Red C On
- TOTI-5 → Signal 1 Yellow A On
- TOTI-6 → Signal 1 D-Yellow A On

With no trains on the track and no points set, the signal will be Green. If Point-1 is set, the feather will light, and TOTI-1, TOTI-2 and TOTI-3 will control the signal aspect. If the point is clear, TOTI-4, TOTI-5 and TOTI-6 will control the signal aspect. If Point-2 or Point-3 are set, the signal will be Red with either route setting, as the route is blocked.

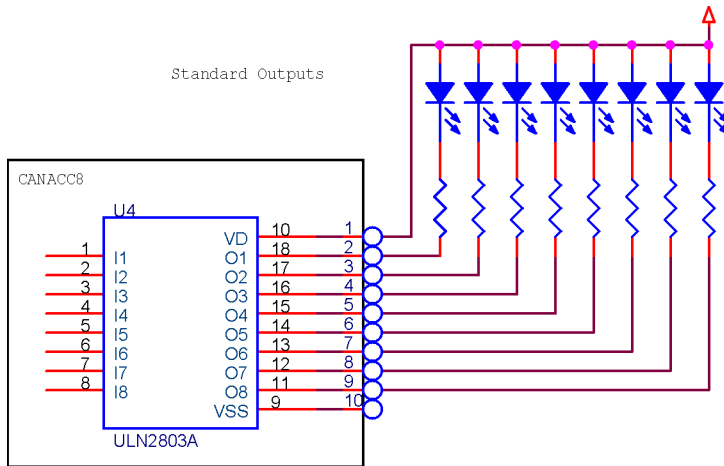
Firmware

Use the CANSIG8 firmware for CANACC8 or FLIM IO boards, and use the CANSIG64 firmware for the CANLED64 board. The easiest way to update the firmware is to use the FCU (V1.4.7.3 or later).

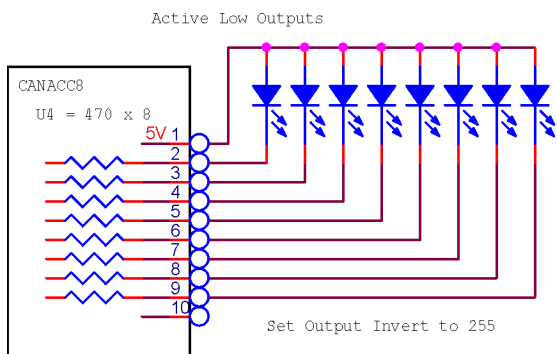
The FCU can also replace existing CANACC8 / CANLED64 firmware with the CANSIG firmware. The FCU will need confirmation that the module type is being changed – this is correct.

CANACC8 Signal Connections

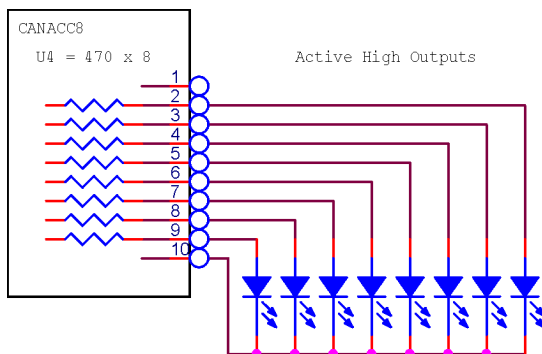
Many options are available for connecting the signal LEDs to the CANACC8 (or FLIM IO) board. The standard method using a CANACC8 board requires no hardware changes, and allows operation from +12V. However, many commercial signals are not wired in a way that can be used with this mode:



By replacing U4 on the CANACC8 with a 8 way DIP resistor network (normally around 470R each), LED's can be driven directly by the processor with either common ground or common 5V options. The use of the resistor network also avoids the need for external resistors.



Alternatively, this arrangement can be used by setting the *Output Inversion* parameter to 255:



To drive 16 LED's from a CANACC8, see the *Multiplexed Output* mode section.

CANLED64 Signal Connections

With CANLED64 hardware, up to 64 LED's are available; the *Display Mode* and *Output Inversion* parameters are ignored and the signals are mapped as shown below.

This allows up to 2 sets of common anode or common cathode LED arrays to be driven for each signal setting. The row outputs should be connected to LED+, the columns to LED-.

Col	Pin	Row1 (Pin10)	Row2 (Pin 11)	Row3 (Pin12)	Row4 (Pin13)
1	2	Signal 1 Red	Signal 2 Red	Signal 3 Red	Signal 4 Red
2	3	Signal 1 Yellow1	Signal 2 Yellow1	Signal 3 Yellow1	Signal 4 Yellow1
3	4	Signal 1 Green	Signal 2 Green	Signal 3 Green	Signal 4 Green
4	5	Signal 1 Yellow2	Signal 2 Yellow2	Signal 3 Yellow2	Signal 4 Yellow2
5	6	Signal 1 Red	Signal 1 Yellow1	Signal 1 Green	Signal 1 Yellow2
6	7	Signal 2 Red	Signal 2 Yellow1	Signal 2 Green	Signal 2 Yellow2
7	8	Signal 3 Red	Signal 3 Yellow1	Signal 3 Green	Signal 3 Yellow2
8	9	Signal 4 Red	Signal 4 Yellow1	Signal 4 Green	Signal 4 Yellow2
9	21	Signal 1 Red	Signal 2 Red	Signal 3 Red	Signal 4 Red
10	20	Signal 1 Yellow1	Signal 2 Yellow1	Signal 3 Yellow1	Signal 4 Yellow1
11	19	Signal 1 Green	Signal 2 Green	Signal 3 Green	Signal 4 Green
12	18	Signal 1 Yellow2	Signal 2 Yellow2	Signal 3 Yellow2	Signal 4 Yellow2
13	17	Signal 1 Red	Signal 1 Yellow1	Signal 1 Green	Signal 1 Yellow2
14	16	Signal 2 Red	Signal 2 Yellow1	Signal 2 Green	Signal 2 Yellow2
15	15	Signal 3 Red	Signal 3 Yellow1	Signal 3 Green	Signal 3 Yellow2
16	14	Signal 4 Red	Signal 4 Yellow1	Signal 4 Green	Signal 4 Yellow2

NV Parameters

Decode Mode

Signal 1 Routed

If checked, Signal 1 is 'routed' using Signal 1 / Signal 2 events.

Signal 3 Routed

If checked, Signal 3 is 'routed' using Signal 3 / Signal 4 events.

Display route with a Red aspect

Normally, a feather or other route indication will not be displayed with a Red signal aspect. If this is checked, the feather or other route indication will always be on if a route is set.

Extended Mode 3

This is not currently used, leave unchecked.

Leave all the boxes unchecked for a standard four signal (unrouted) setup.

Auto Timers

Red->Green Time

If this is non-zero, and a signal changes from Red → Green, a Yellow aspect will be automatically displayed for this number of seconds. Once this time expires, a timed Yellow → Double Yellow transition will be actioned if the *Yellow-Green Time* is also enabled.

Yellow->Green Time

If this is non-zero, and a signal changes from Yellow → Green, a Double Yellow aspect will be automatically displayed for this number of seconds.

The Timer Mode Parameters allow 3 and 4 aspect signals to be used when insufficient TOTI indications are available. Any timed output is automatically cancelled if another event is received for that signal.

Extended Configuration

This is not currently used; leave set to 0.

Display Mode (CANSIG8 Only)

This parameter is only relevant for the CANSIG8 firmware, and controls how the signals are connected to the eight output pins, OP1..OP8

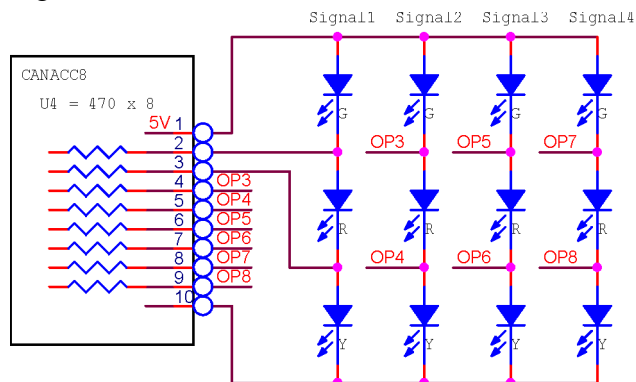
4 x Two Aspect (default)

OP1	Signal 1 Red
OP2	Signal 1 Green
OP3	Signal 2 Red/Signal 1 Feather On
OP4	Signal 2 Green/Signal 1 Feather Off
OP5	Signal 3 Red
OP6	Signal 3 Green
OP7	Signal 4 Red/Signal 3 Feather On
OP8	Signal 4 Green/Signal 3 Feather Off

Any Yellow or Double-Yellow settings are shown as Green.

4 x Three Aspect Colour

This mode requires U4 to be replaced with a 8 x 470R resistor network, and uses custom LED wiring as follows:



Note that this will ONLY work with standard LED's of the colours shown. Any Double-Yellow setting is shown as Yellow

2 x Four Aspect Colour

OP1	Signal 1 Red
OP2	Signal 1 Yellow1
OP3	Signal 1 Green
OP4	Signal 1 Yellow2
OP5	Signal 3 Red

OP6	Signal 3 Yellow1
OP7	Signal 3 Green
OP8	Signal 3 Yellow2

2 x Three Aspect with Feather

OP1	Signal 1 Red
OP2	Signal 1 Yellow
OP3	Signal 1 Green
OP4	Signal 1 Feather On
OP5	Signal 3 Red
OP6	Signal 3 Yellow
OP7	Signal 3 Green
OP8	Signal 3 Feather On

Any Double-Yellow settings are shown as Yellow

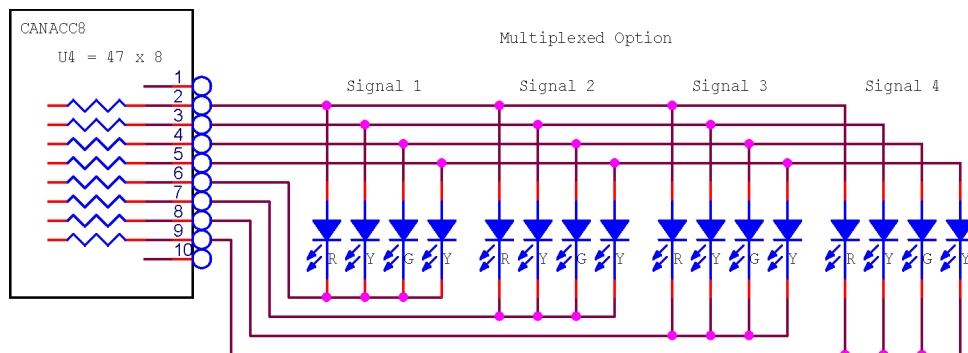
1 x Four Aspect with Feather, 1 x Three Aspect

OP1	Signal 1 Red
OP2	Signal 1 Yellow1
OP3	Signal 1 Green
OP4	Signal 1 Yellow2
OP5	Signal 3 Feather On
OP6	Signal 3 Red
OP7	Signal 3 Yellow
OP8	Signal 3 Green

Any Double-Yellow setting for Signal 3 is shown as Yellow

4 x Four Aspect Multiplexed Output

This can drive up to 16 LED's from the eight CANACC8 outputs.



If a 47R x 8 resistor network is used, the average LED current will be around 5mA, which is fine for high efficiency LED's. If higher LED currents are required, use a CANLED64 board. Due to the limited drive from the microprocessor, there may be slight dimming of the other LED's when switching to/from a double yellow aspect.

The LED arrangement can be inverted by setting the *Output Inversion* parameter to 255.

Extended Modes 6-9

These are for future firmware releases.

Output Inversion (CANSIG8 Only)

This parameter is only relevant for the CANSIG8 firmware, and allows the polarity of any of the eight outputs to be inverted if the relevant box is checked.

Event Selection

Each decoded CBUS event may set or reset one or more of 64 internal “flags” in the CANSIG using a similar dialogue to that of the CANLED64.

One tab on the form is used for each signal. Each event can set any number of flags On or Off.

Normally, 16 of these flags are used to control each signal as follows:

```
if (Red A or Red B or Red C or
    Red D or Red E or Red F) are 'On', then signal RED
else if (Yellow A or Yellow B or Yellow C or
        Yellow D or Yellow E or Yellow F) are 'On' then signal YELLOW
else if (D-Yellow A or D-Yellow B or
        D-Yellow C or D-Yellow D) then signal DOUBLE YELLOW
else signal GREEN
```

For a routed signal, two sets of 15 flags is used to control the setting depending on the two route setting flags:

Signal 1:

```
if (Signal1:D-Yellow D/Alt or Signal2:D-Yellow D/Alt) are 'On' then
    use Signal 2 flags, else use Signal 1 flags
```

Signal 3:

```
if (Signal3:D-Yellow D/Alt or Signal4:D-Yellow D/Alt) are 'On' then
    use Signal 4 flags, else use Signal 3 flags
```

This allows different inputs to be used to control the signal based on a point or other setting.

Whilst this seems complex, it does allow for a reasonably correct signal display even on a large and complicated layout.

Note that only three D-Yellow flags are available for each signal/route in this mode as the fourth is used for route selection.