CapLite 64 and 96
Setup & Installation Guide

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Introduction

The new CapLite offers a standard package of either 64 or 96 stops. While still using the same high-quality parts and a ready to go from the box system the fixed specification allows us to bring you a very affordable high-performance system.

If you need to upgrade the system in the future or add a switching system, the new CapLite is part of the MSM family, and your investment is secure.

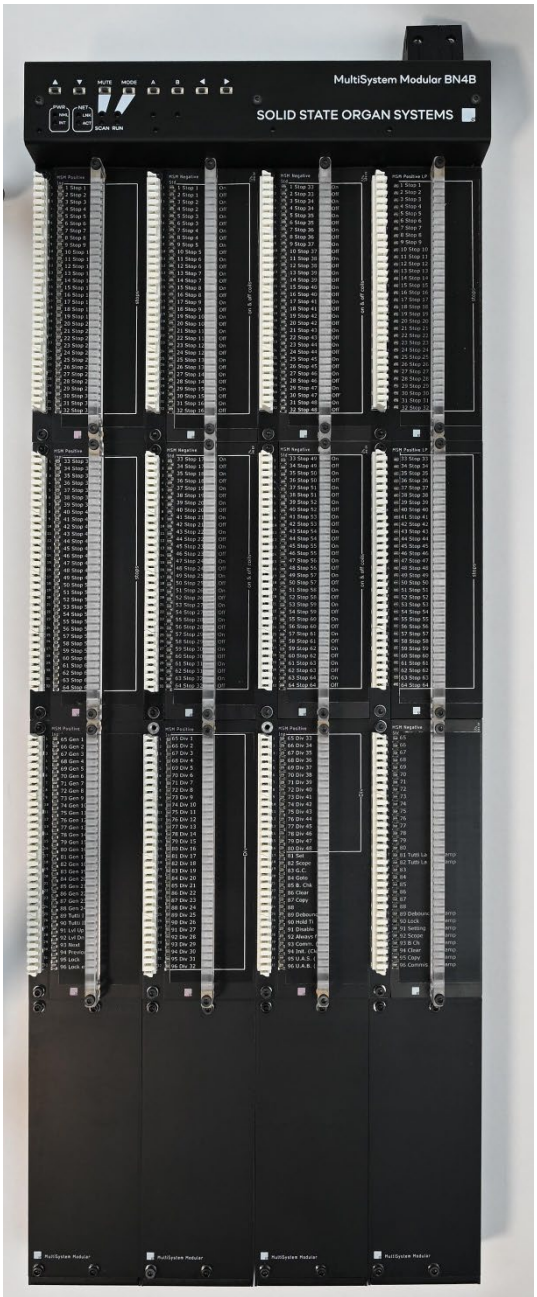
Overview of the Parts

Unpacking

In addition to the CapLite Module the system includes:

- CapLite Processor
- Krone Punch Tool
- Main control panel
- USB cable for the display
- 4 mounting brackets
- Cat5 cable

The CapLite Module



All the wiring is contained in one module which is the same size for both the 64 and 96 stop version. Dimensioned drawings are included at the end of this book.

The stops are arranged in columns with built in connector listings. Stops are at the top of each column and pistons at the bottom and lamps on the last card.

Column 1 stop inputs (Positive Input)

Column 2 and 3 On and Off coils (negative going)

Column 4 Stop action outputs (Positive going)

All piston inputs are positive, and all lamp outputs are negative.

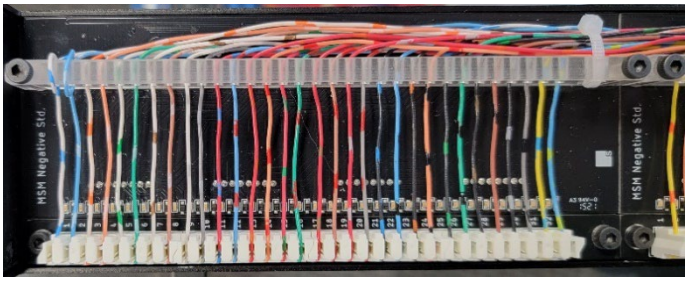
Modules support Krone connections and cable registers. CapLite also has built in wiring summaries right next to the wires.

Krone connection blocks are removeable to allow card swapping without rewiring.

Outputs are individually fused and electronically current protected.

All connections have an LED to check wiring.

Wires are run from through the cable register passing over the LEDs which are visible between the gaps.



CapLite Processor

The CapLite has a central processor. This is connected to the CapLite module using a Cat5 cable, we supply a 2 metre (6ft) cable, but this can be replaced by any good quality Cat5 cable (Cat6 and Cat7 are also OK) up to 80 metres if you wish. Longer cables can be terminated using our link protection boards. Unless you have the correct tools and experience do not attempt to make your own connections to the RJ45 plugs.

The CapLite processor requires DC organ power 12 – 36 Volts. The green connector is fitted to the processor for safe keeping but can easily be removed. There are two screw terminals and a red marker for positive.

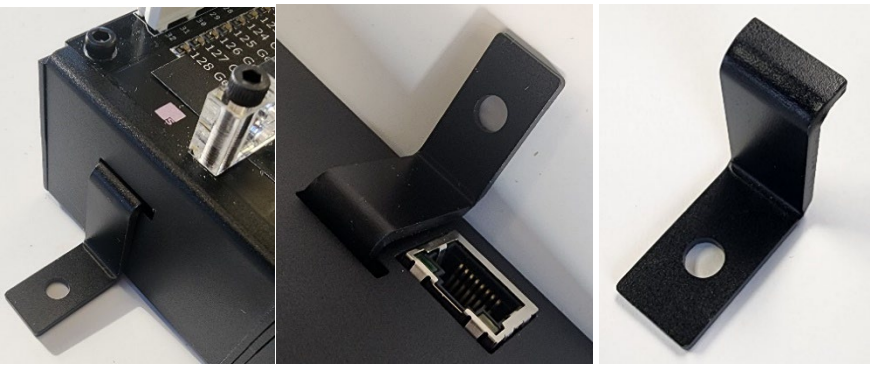
The memory display is connected to this box and so if the wiring must be placed at a distance from the console the processor may be attached to a closer point and run the display.

Fitting the system

Mounting Brackets

Each module has slots in the metalwork and small brackets that can be dropped in and used to secure the module to the organ.

Slots are provided at the bottom to make it easier to attach to a vertical surface, the brackets may be fitted first and then the module dropped onto them.



There are also slots on the top of the 4-column module for brackets.

Connections

The CapLite requires DC power and Ethernet to operate. Connections to the organ are normally through Krone punch blocks which are compatible with 22 and 24 AWG insulated wire and require a Krone Tool to punch in the wires. Be aware that the pitch of the connections is smaller than the MultiSystem planes you may be familiar with.

Power

The CapLite is powered from “organ power” 12 – 36V DC. The system requires a very small current to operate, less than 1A and so all the cable thickness planning is related to the load the console will put on the module.

Connect Positive power to the Red marked terminal. We recommend using at least 14AWG cable to conform to NEC specification.

Negative Output modules can switch up to 1 A per circuit and so the negative cable to the module must be capable of returning this current to the power supply.

Power Connector ratings and cable trimming.

Strip 0.6” 16mm

The high quality power connectors are UL rated to 85A and will accept cables from 0.5-2.5mm2, 20-4 AWG. Cables must be stripped to 16mm, 0.6” if the cable is stripped shorter the clamping system will not operate correctly and the organ may be unreliable. If the cable is stripped longer bare wires may be visible.

The cable must be pushed all the way into the connector after loosening the screw to make a reliable solid connection.

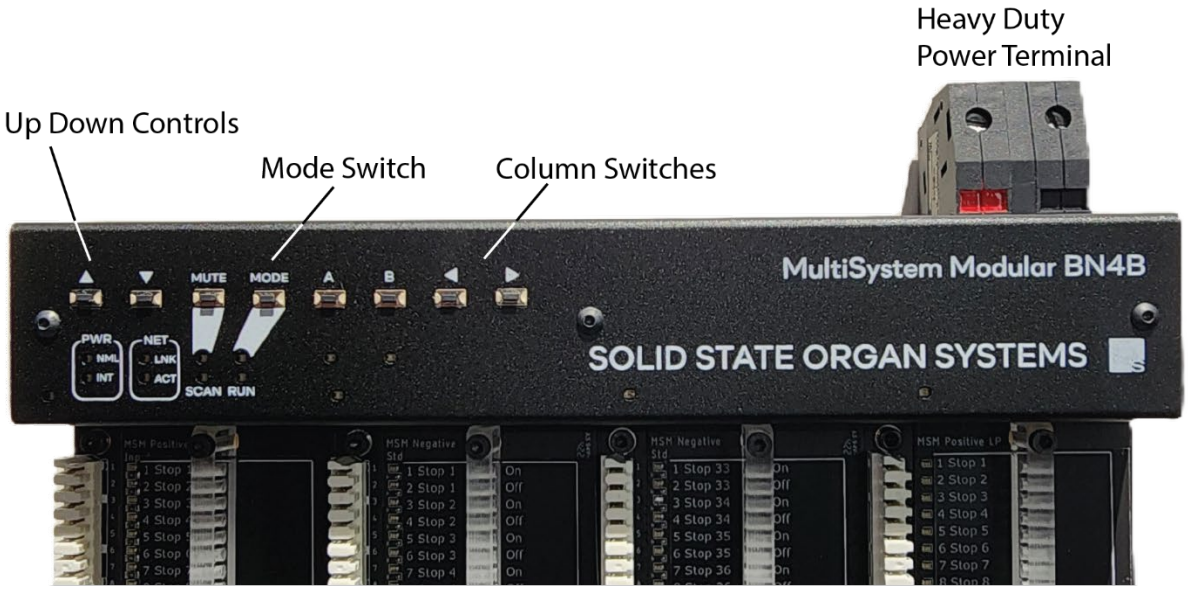
Ethernet

The module is fitted with a standard RJ45 Ethernet connection as is the CapLite processor. It uses standard Cat5e or Cat6 cables for communication between modules and the CapLite Processor. We strongly recommend you purchase ready-made cables where possible. They are cheaper and more reliable than making your own.

Tips for successful installation with Cat5/6 cables

1. Never run more than 80 metres or 240 feet between devices
2. If you make your own cables strictly observe the colour code that comes with the connectors
3. Do not pinch the cable with tight fixing as it can reduce the data capacity.
4. Do not bend the cable tighter than what would wrap around a pencil.
5. Discard any cable with a broken clip.
6. Make sure the connectors don’t have tension on them.
7. Consider using fibre optics for long runs.
8. Never split cables to connect to more places such as joining inputs. Every cable must go from one device to another. The cable maybe spliced and also travel through suitable connectors.

Module Controls



Summary of a good module:

INT red Led lit

Network LEDs. Link solid green, Activity flashing.

Scan Green LED lit

Mode Solid Green

Run Solid Amber

The LEDs on the module control panel are grouped into sections.

Power indicators. When a module is powered and the internal supply is good the INT LED will light red.

Network Indicators. These are a duplicate of the indicators on the network connector, displayed here for convenience.

The **Scan LED** lights green when the individual cards on the module are being read. The scan LED will flash briefly during start up and then come on solid once the module is running. If it flashes but stays off, there is a problem.

Each MultiSystem Modular has a set of 3 LEDs and 4 buttons to assist with setting up a rank. The module does not need to be connected to the network to do this.

The **Mode Button** is used for switching between different modes:

1. Normal Operation
2. Wiring/Auto Mode
3. Test/Manual Mode

To Exit normal operation and enter wiring or manual mode press and hold the Mode button until the Mode LED starts flashing.

The **Mode LED** indicates the current processor mode:

In normal operation the mode LED will be lit solid, in wiring mode it will flash slowly, and in manual mode it will flash quickly.

The **Run LED** shows the processor state:

It will flicker off as the processor completes a task. It should be lit with some occasional flickering.

The **Mute LED** shows if the processor has the outputs muted.

The 3 other buttons will not function in normal mode.

Column Switches At the top of each column is a green LED which indicates the active column when the Wiring or Manual mode is selected. The left and right arrows mark the switches that change the selection which is shown by the LED.

Using Wiring/Manual modes

Wiring and manual modes are similar, they offer ways to step each output on, one at a time.

To get started enter the mode wanted using the Mode switch and choose an output column using the column switches and press the Down Arrow as this feature only works on output cards.

In wiring mode, the output will automatically step in 1 second increments, you can press the Down button to jump forwards another step instantly. Select column 2 or 3 and the CapLite will sequence through the on and off coils moving the tops on and off. Perfect for testing the wiring.

Pressing Up Arrow reverses the stepping direction and once going backwards can step instantly.

Manual mode is the same, but the outputs don't increment automatically.

At any time, you can press Mute to turn off the current pin (the mute LED will light), you can then press it again to go back to where you were.

If the processor steps to the end of the pins it will turn of the outputs, pressing Down will then start you at pin 1 again. If you step off pin 1 going backwards, you will need to press Down again to restart the stepping.

The operation on the 4-column module is the same but there is an additional pair of buttons that choose the column under control for wiring and test modes.

The left and right arrows will change the green LED at the top of one of 4 columns.

LEDs on individual cards

Each circuit has a tiny LED next to the Krone connection. It has three possible states. Off, dim and bright

Inputs: Normally off and will be bright with an input

Negative Output:

- Off, connected to a coil load but off.
- Dim, not connected to a load and off (can indicate a fault if you expect the load to be connected)
- On, On

Wiring the Krone connections

For convenience all the wiring information is printed on plastic cards which are retained by the cable registers. The 64 stop version has cards 1 and 2 (pins 1-64) allocated to stops. The 96 Stop version has cards 1,2 and 3 allocated to stops. All the remaining controls are below this.

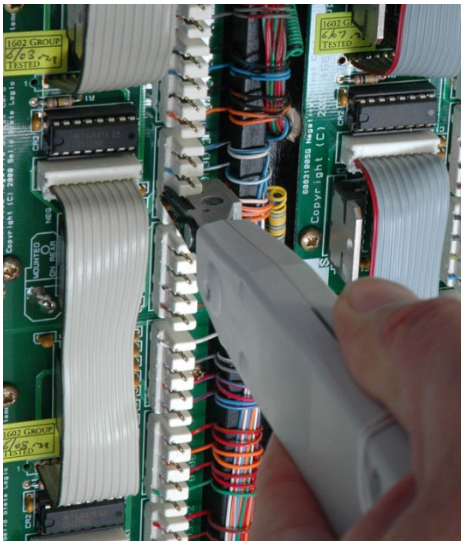
Column 1 Stop Switch inputs
Column 2 and 3 On and off coils in on-off sequence
Column 4 Stop action outputs to the relay

Use of the Special Tool

To terminate the system correctly you will require a special insertion/removal tool. The tool supplied is a professional quality tool and should last a lifetime. Spare tools are obtainable directly from SSOS or other suppliers.

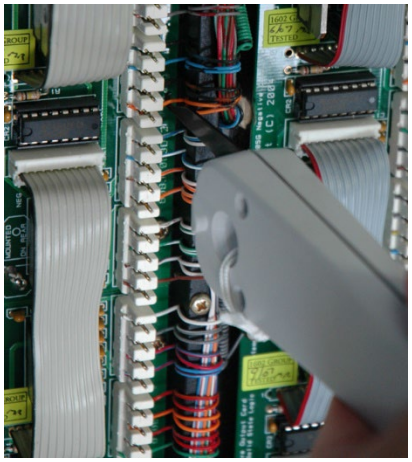
Use only the special tool to insert wires.
Any other tool will damage the blocks and cause unreliability.

The tool has a number of functions. It can be used to insert wires or remove them from the blocks. It is also capable of cutting off excess wire if required.



If you wish to cut off the excess wire, remove the clip at the bottom of the tool and allow it to hang free on the string. If you wish to link the wire onto another point, make sure the clip is in place and this will prevent the cutters operating. Please be very careful not to allow the wire clippings to fall into the electronics where they may cause damage.

To insert a wire, place the wire over the top of the connection block. Insert the tool into the block with the grey plastic part closest to the cable register and the cutters nearest the components. The small groove in the bottom of the tool should rest on the wire. Push the tool firmly into the block. If the cutters are enabled, you will feel and hear a click as the excess wire is trimmed.



Removing wires is done with the other end of the tool. At the side is a black metal clip. Pulling this out in the same way as a penknife will reveal the removal tool.

Hook the wire between the block and the cable register and pull the wire out.

Assembling the System

Control Panels:

The CapLite comes as standard with the new TFT colour display which shows memory level and last general piston. If space is limited on the console, it is possible to change this for the individual control panels and use pistons to control the memory level and sequencer.

The display is connected directly to the CapLite processor using a USB cable which connects to the screw terminals of the display. If you wish to shorten the cable, please do so but we recommend tinning the wires afterwards.

The alpha display with buttons can be configured after installation by pressing all 4 buttons at the same time to enter the setup mode. The hardware is symmetrical and so can be mounted either way up as there is a sensor (the bit that rattles) that detects which way up the display is on power up and rotates it. If you mount the display horizontally, in a drawer for example, we suggest you go into setup mode and fix the orientation from the menu. (press all 4 buttons)

Rotary Switch for memory Levels

If your system shipped with a rotary switch option, the wiring for the general pistons and the levels is at the bottom of column 1 as follows. Connect the supplied rotary switch with the common to positive.

65	Positive Inputs	General Piston 1
66		General Piston 2
67		General Piston 3
68		General Piston 4
69		General Piston 5
70		General Piston 6
71		General Piston 7
72		General Piston 8
73		General Piston 9
74		General Piston 10
75		General Piston 11
76		General Piston 12
77		General Piston 13
78		General Piston 14
79		General Piston 15
80		General Piston 16
81		General Piston 17
82		General Piston 18
83		Level 1
84		Level 2
85		Level 3
86		Level 4
87		Level 5
88		Level 6
89		Level 7
90		Level 8
91		Level 9
92		Level 10
93		Tutti I
94		Tutti II
95		Lock
96		Lock enable

Connecting pistons and console controls 64 and 96 Display Version

Note: pin numbers on the 96 stop version will be 32 higher as the cards will start at pin 97

All piston and control signals are positive inputs to the system.

Column 1 and 2

	Positive Inputs
65	General Piston 1
66	General Piston 2
67	General Piston 3
68	General Piston 4
69	General Piston 5
70	General Piston 6
71	General Piston 7
72	General Piston 8
73	General Piston 9
74	General Piston 10
75	General Piston 11
76	General Piston 12
77	General Piston 13
78	General Piston 14
79	General Piston 15
80	General Piston 16
81	General Piston 17
82	General Piston 18
83	General Piston 19
84	General Piston 20
85	General Piston 21
86	General Piston 22
87	General Piston 23
88	General Piston 24
89	Tutti I
90	Tutti II
91	Lvl Up
92	Lvl Dn
93	Next
94	Previous
95	Lock
96	Lock enable

	Positive Inputs
65	Div 1
66	Div 2
67	Div 3
68	Div 4
69	Div 5
70	Div 6
71	Div 7
72	Div 8
73	Div 9
74	Div 10
75	Div 11
76	Div 12
77	Div 13
78	Div 14
79	Div 15
80	Div 16
81	Div 17
82	Div 18
83	Div 19
84	Div 20
85	Div 21
86	Div 22
87	Div 23
88	Div 24
89	Div 25
90	Div 26
91	Div 27
92	Div 28
93	Div 29
94	Div 30
95	Div 31
96	Div 32

Column 3 and 4

	Positive Inputs
65	Div 33
66	Div 34
67	Div 35
68	Div 36
69	Div 37
70	Div 38
71	Div 39
72	Div 40
73	Div 41
74	Div 42
75	Div 43
76	Div 44
77	Div 45
78	Div 46
79	Div 47
80	Div 48
81	Set
82	Scope
83	G.C.
84	Goto
85	B. Chk
86	Clear
87	Copy
88	not used
89	Debounce extend
90	Hold Time extend
91	Disable SET
92	Always fire all coils
93	Comm. (Commissioning Mode)
94	Init. (Clear/Init. All)
95	U.A.S. (Update All Scopes)
96	U.A.B. (Update All Blinds)

	Negative Outputs
65	not used
66	not used
67	not used
68	not used
69	not used
70	not used
71	not used
72	not used
73	not used
74	not used
75	not used
76	not used
77	not used
78	not used
79	not used
80	not used
81	Tutti Lamp
82	Tutti Lamp
83	not used
84	not used
85	not used
86	not used
87	not used
88	not used
89	Debounce Lamp
90	Lock Lamp
91	Setting Lamp
92	Scope Lamp
93	B. Chk Lamp
94	Clear Lamp
95	Copy Lamp
96	Comm. Lamp

Piston Wiring Column 1

General pistons MUST be wired in the correct order with General Piston 1 input wired to General Piston 1, and without gaps. The display will show the general piston based on the pin number. This will also ensure correct operation of the piston sequencer or stepper, even if you are not planning to add a piston sequencer it may be asked for at a later date.

There are 24 Generals on the display version and 18 on the rotary switch version.

Pin 89 and 90 Tutti. (121 and 122 on the 96 stop version) Two independently settable inclusive Tutti reverser inputs with lamp outputs on column 4. The tuttis are set during commissioning mode and are not settable by the organist, each tutti adds to the current registration and will cancel the other tutti if it is on. Only one tutti will be on at the same time.

Pin 91 and 92 Level Up and Level Down (123 and 124)

Inputs provided to wire regular pistons to operate memory up and down. These may be used in addition to the control panel unless the rotary switch is in use.

Pin 93 and 94 Sequencer Next and Previous (125 and 126)

Inputs provided to wire regular pistons to operate the piston sequencer (stepper). You may wire multiple pistons to the same pin but only put a maximum of two wires in the Krone connectors. Remember the stepper is not available with the rotary memory control. The piston sequencer steps through the general pistons that have been scoped in the order they are on the connector list. When the organist reaches the highest numbered piston the memory is increased and the process repeats from piston 1.

Pin 95 Lock (127) and **Pin 96 Lock Enable** (128)

To provide memory locking for each level a permanent positive connection needs to Locking Enable and then a lock switch wired to provide a momentary positive which will reverse the lock status of the current memory level. Key switches are available from us.

Piston Wiring Column 2

Pin 65-96 Divisional Pistons 1 -32 (97 – 128)

Divisional pistons include any controls that are not Tuttis or Generals. More detail is available in the commissioning section. In summary the function of a piston is the scope, for example a swell divisional piston has a scope of the swell stops. A reverser piston only has the scope of the one stop it controls.

Piston Wiring Column 3

Pin 65-80 Divisional Pistons 33 -48 (97 – 112)

Divisional pistons maybe wired in any order. During the commissioning process we will teach the system which piston controls which set of stops.

Pin 81 Set (113)

Pin 82 Scope (114)

The scope input is used to program the “scope” of the pistons. Normally it is fitted to a small latching switch inside the console so the pistons can be setup. On some instruments it can be provided as a piston next to the setter (sometimes under the keyboard) so the organist can rescope pistons on different memory levels.

Pin 83 General Cancel (115)

Pin 84 Go To (116)

Go To enables a shortcut to different memory levels. Holding Go To and then entering a memory level on the General Pistons with take you straight there. General 10 is treated as a Zero. As an option this pin may be wired to the General Cancel piston so holding GC will allow a quick navigation.

Pin 85 Blind Check (117)

This is a reverser input. When a positive is momentarily connected to Blind Check the Tutti pistons will behave as General Pistons and can be set using this input during commissioning. The Blind Check Lamp will be lit when Blick Check is active.

Pin 86 Clear (118)

When held with Set the Clear piston will clear the current memory level but retain the scope settings. This will then show a C on the display showing the level is empty and available for use. If you continue to hold Set and press Clear again the Scopes will also be “cleared” to default settings. If you continue once again to hold Set and press Clear a third time all pistons on the current level will be blank and the scopes will be reset to be the same as General Cancel.

Pin 87 Copy (119)

The Copy piston copies the current level and pastes it to another. Use Set+Copy to capture the current memories, scroll to another level and press Set+Copy again to paste it.

Pin 89 Debounce Extend (121)

All contacts will bounce a little when pressed, they are springs after all. This becomes a problem with reversers and the stepper as it can cause the pistons to behave erratically. We always wait a short time for the piston bouncing to settle before reading it again but on older worn contacts especially if they are pitted the bouncing can go on longer. If you see erratic behaviour connect this to positive. It will slow down the repetition of the reversers a bit so only add this if needed.

Pin 90 Hold Time Extend (122)

Hold time is the length of time the on and off coils are energized. If some of the knobs are not always moving when a piston is pressed and adjusting the voltage is not an option adding a positive to this pin will extend the length of time the coils are energized. Check the power supply is providing adequate current, if the problem is related to the number of stops that move not specific stops then the power is likely to be weak.

Pin 91 Disable Set (123)

Pin 92 Always fire all coils (124)

If you wire a crescendo roller to the inputs through diodes to prevent cross feeding it is a good idea to connect Disable Set and Always Fire All Coils to the crescendo stage 1. This will change the system when the crescendo shoe is open so it is not possible to set combinations that include the crescendo and also without “Always Fire All Coils” enabled the stops that are on in the crescendo will not move on the console if a piston is pressed that has them set which is confusing.

Pin 93 Commissioning Mode (125)

Wire this to an internal switch to access Commissioning Mode for setting up the system.

Pin 94 Initialize Clear All (126)

Automatically copies all the settings set in Commissioning Mode to all the levels. It will delete all the memories previously set.

Pin 95 Update All Scopes (127)

As we mentioned the scope of the pistons defines what they control. If there are pistons set on the system but the organist requests changes to the scopes, then change the scopes in commissioning mode and use Update All Scopes to change the scopes of all the levels without affecting the piston memories. This will of course overwrite any custom scope settings on a level.

Pin 96 Update All Blinds (128)

The setting for the Tuttis is stored during commissioning. If you update the master, then a positive on this pin will copy the new setting to all the levels.

Lamp Wiring Column 4 (All these are Negative Outputs)

Pin 81 Tutti Lamp 1 (113) **Pin 82 Tutti Lamp 2** (114) Lamp outputs with a positive return

Pin 89 Debounce Lamp (121) No need to wire this as the LED on the module will light to show the debounce, it is useful to see if a piston was read by the system as the LED will flash every time a piston is pressed.

Pin 90 Lock Lamp (122) Lights when memory level is locked. Also shows on the main display.

Pin 91 Setting Lamp (123) Flashes the LED when a piston is set. This also happens on the main display.

Pin 92 Scope Lamp (124) Shows that scope is on

Pin 93 Blind check Lamp (125) Shows Blind Check is active when commissioning the tuttis.

Pin 94 Clear Lamp (126) Memory Level Clear, this is on the display but useful for a rotary control version.

Pin 95 Copy Lamp (127) When a memory level is copied the LED lights, once the level has been pasted it goes out ready for the next copy.

Pin 96 Commissioning Lamp (128) LED lights when in commissioning mode

What to expect from a factory set system

The system is fully programmable using the procedure in the next section. However, we have setup a few things so you will be able to test the console immediately the wiring is complete.

General Cancel is programmable, but we have set it to cancel all the stops. If you wish to remove some stops from GC simply rescope it during commissioning.

Commissioning process:

Before beginning.

Please read these instructions to familiarise yourself with the process. If you have any questions, please don't hesitate to contact us for more information.

Make sure you have wired the system as per the provided connector list. If you have a generic block of divisional pistons, these may be used in any order and for divisional pistons, cancels, or simple reverser pistons.

Please note that general pistons MUST be wired in the correct order with General Piston 1 input wired to General Piston 1, and without gaps. This will ensure correct operation of the piston sequencer.

Set = hold set control and press the control/piston

Scope = hold set and scope controls, press the control/piston

Note: Tutties and general cancel may only be set/scoped while in commissioning mode.

Process

1. Turn on the input labelled "Commissioning Mode" by briefly pressing the button you installed earlier. Commissioning mode edits a special memory that is used to store all the defaults. The display will show 0
2. Scope General Cancel to the stops to be affected by the capture system (usually all stops on the console) Note: This is new as in previous systems there was no option to scope the GC.
3. Scope the general pistons (any order is fine) to the stops to be affected by general pistons and stepper/sequencer.
4. Scope the pistons in each division to the stops they should change for that division.
5. Scope any reverser pistons to the single stop they should reverse (MUST be a single stop ONLY or it will act as a normal piston)

6. Setup the default Tutti (Optional) Currently only Tuttis inclusive of stops drawn are supported.
    1. Turn on Blind Check (control panel)
    2. Turn on all stops to be set on the Tutti
    3. While holding SET and SCOPE Press the Tutti (scopes the Tutti)
    4. Release SCOPE
    5. Now Set the Tutti reverser piston
    6. Turn off Blind Check

Warning: This next part will erase all the levels and save the defaults you have set in the previous instructions.

7. While still in Commissioning Mode Turn on the input labelled "Initialize"
8. This will clear each level in turn, the set lamp will be lit and you may see the display scroll levels

9. The system will now be on Level 1, out of commissioning mode and you can test the defaults.
10. To make any changes, go back to instruction 1
11. If you wish to edit the tutti, then exit out of this sequence prior to section 7 by turning off the console.

In case you try it

Before commissioning you can still control the level and try to step the sequencer, however it will act as if there is only general 1 on each level and it is blank. Stepping generals backwards will not work because there are no pistons on the previous level. Levels will change correctly, with each reporting as clear.

Setting a piston is best avoided until commissioning is complete.

Update All Scopes

If you wish to change the default scope of every memory after the console has been in use, use the Update all scopes option after editing the default in commissioning mode. This is controlled by a pin on the pinboard listed in the connector listing. Update All Scopes will always update all the scopes without affecting the memories. If a setting has a stop that is now outside the new scope the stop will not operate until the Scope is changed to allow it. Update all scopes also updates the scopes of the Tutti and inhibits.

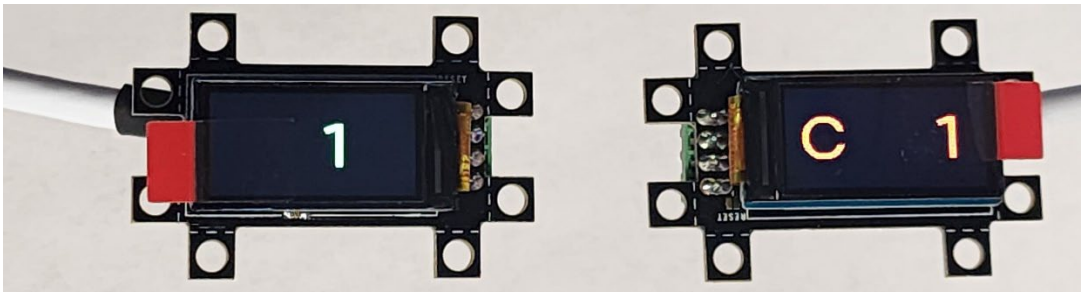
Update All Blinds

Follow the same procedure as update all scopes to update the setting and scope of the Tuttis and inhibits.

Factory Reset:

1. Enter Commissioning mode.
2. Do triple clear (Positive to clear input 3 times) to completely remove all default files.
3. Put a positive to the Initialize pin to copy the empty system to all the levels.

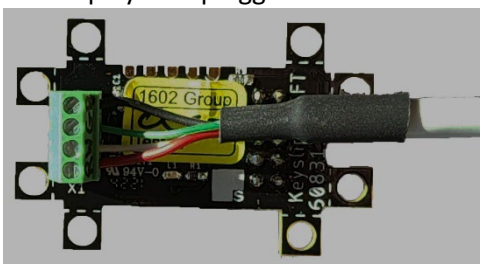
Optional Individual displays



Control panels can be self-contained or split to be installed in keyslips and piston rails. Each display is connected with a USB cable and the displays may be fitted either way up to facilitate tight fitting. However, at this point the keyslip display needs to be ordered inverted and with a choice of colour.

It is also possible to have both memory level and piston on one display with smaller text upon request.

The displays are plugged into the control server with traditional USB plugs and as always with USB any connection on the server will work.



The USB cable is provided with stripped and tinned wires ready to be connected to the screw terminals. If you wish to shorten the cable no problem.

The colours of the cable are either written on the connector or on the circuit board.

The mounting tabs on the keyslip display may be carefully removed along the dotted lines. Please do not file any of the circuit boards as there are hidden tracks that may be damaged.

Two keyslip displays may be mounted close to each other with the tabs removed, one can be inverted to make the digits closer together. Please ask us for an inverted display.

Useful information

Cable Calculator

Use the first table to calculate the current that the cable will need to carry.

If the cable will be supplying current to more than one load add all the currents together (e.g. 61x 70 ohm magnets with a 15V supply = 61 x 0.2A = 12.2A).

Use the second table to find the cable thickness required for the load.

If the cable will be more than 10 metres (30 feet) long, then use the next size up.

Current has been calculated at 6A per square mm.

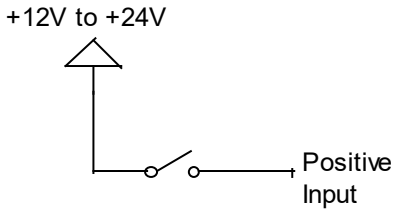
		Load (Ohms)								
		10-11	12-14	15-19	20-29	30-49	50-69	70-99	100-149	150-9999
Voltage	10	1.0A	0.8A	0.7A	0.5A	0.3A	0.2A	0.1A	0.1A	0.1A
	12	1.2A	1.0A	0.8A	0.6A	0.4A	0.2A	0.2A	0.1A	0.1A
	14	1.4A	1.2A	0.9A	0.7A	0.5A	0.3A	0.2A	0.1A	0.1A
	15	1.5A	1.3A	1.0A	0.8A	0.5A	0.3A	0.2A	0.2A	0.1A
	16	1.6A	1.3A	1.1A	0.8A	0.5A	0.3A	0.2A	0.2A	0.1A
	17	1.7A	1.4A	1.1A	0.9A	0.6A	0.3A	0.2A	0.2A	0.1A
	18	1.8A	1.5A	1.2A	0.9A	0.6A	0.4A	0.3A	0.2A	0.1A
	20	2.0A	1.7A	1.3A	1.0A	0.7A	0.4A	0.3A	0.2A	0.1A
	22	2.2A	1.8A	1.5A	1.1A	0.7A	0.4A	0.3A	0.2A	0.1A
	24	2.4A	2.0A	1.6A	1.2A	0.8A	0.5A	0.3A	0.2A	0.2A

$I = V \div R$

European Wire Gauges				American Wire Gauges			
Strands/dia.	SWG	CSA	Max Current	Strands/AWG	AWG	CSA	Max Current
7/0.2	24	0.22	1.4A	7/32	24	0.000341	1.3A
16/0.2	21	0.50	3.0A	7/30	22	0.000533	2.0A
24/0.2	19	0.75	4.5A	10/30	20	0.000761	3.0A
32/0.2	18	1.01	6.0A	16/30	18	0.001217	4.7A
50/0.2	17	1.57	10.0A	26/30	16	0.001978	7.5A
1/1.78	15	2.50	15.0A	41/30	14	0.00312	12.0A
7/0.85	13	4.00	24.0A	65/30	12	0.004946	19.0A
7/1.04	11	6.00	36.0A	105/30	10	0.007989	30.0A
7/1.35	9	10.00	60.0A				
Strands/dia = number of strands, each of diameter in mm				Strands/AWG = number of strands, each of gauge			
SWG = Standard Wire Gauge (British)				AWG = American Wire Gauge			
CSA = Cross sectional area (mm^2)				CSA = Cross sectional area (in^2)			

Input and Output Polarity

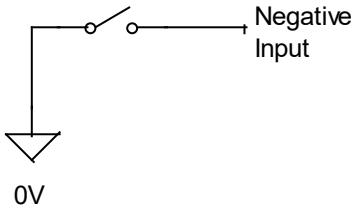
Positive Input



For switch contacts the feed should be positive.

- These are for switches, contacts and signals which give a voltage above 10V when the switch is on (closed)
- When the switch is off, there should be no connection (open circuit) or a low voltage (less than 1.5V)

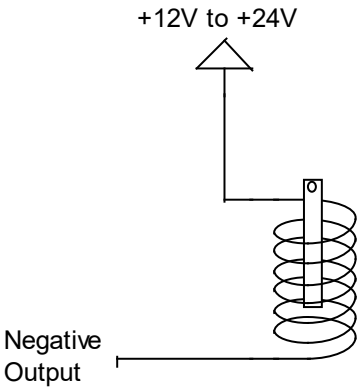
Negative Input



For switch contacts the feed should be 0V.

- These are for switches, contacts and signals which give a voltage below 1.5V when the switch is on (closed)
- When the switch is off, there should be no connection (open circuit) or a high voltage (more than 10V)

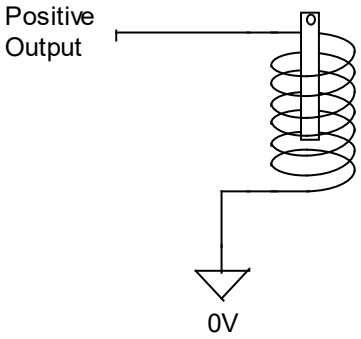
Negative Output



For magnets the return should be positive.

- These are for magnets (electro-magnets/solenoids) and lamps with a positive common
- When the output is on, it will connect to 0V

Positive Output



For magnets the return should be 0V.

- These are for magnets (electro-magnets/solenoids) and lamps with a negative common
- When the output is on, it will connect to the positive supply

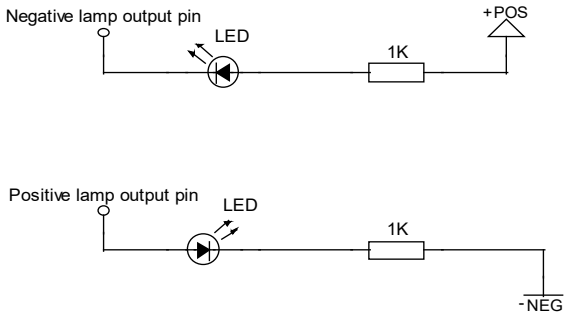
For voltages outside of the indicated ranges please contact our service team for advice.

Connecting Light Emitting Diodes (LEDs).

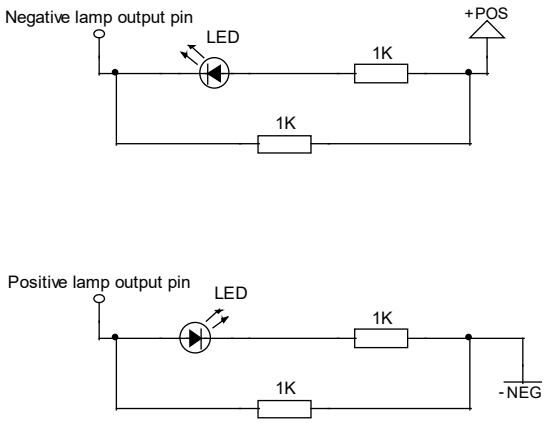
LEDs require the current through them to be limited to 20mA or less. For a bright LED we recommend 10mA and for a dim LED we recommend 5mA.

For 10mA (Normal brightness) 12-18V use 1K, 18-24V use 2K.

For 5mA (Low brightness) 12-18V use 2K, 18-24V use 3K9.

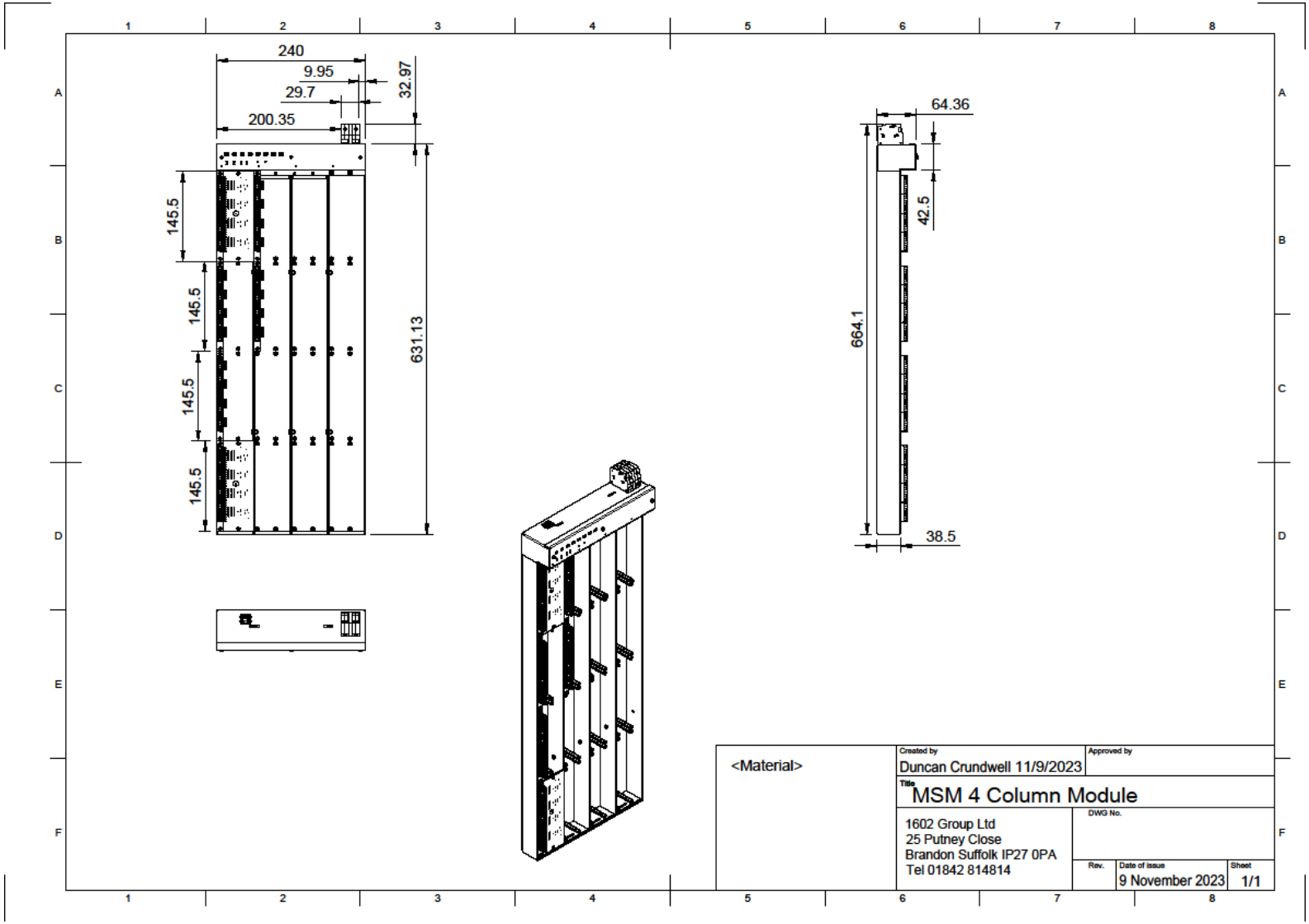


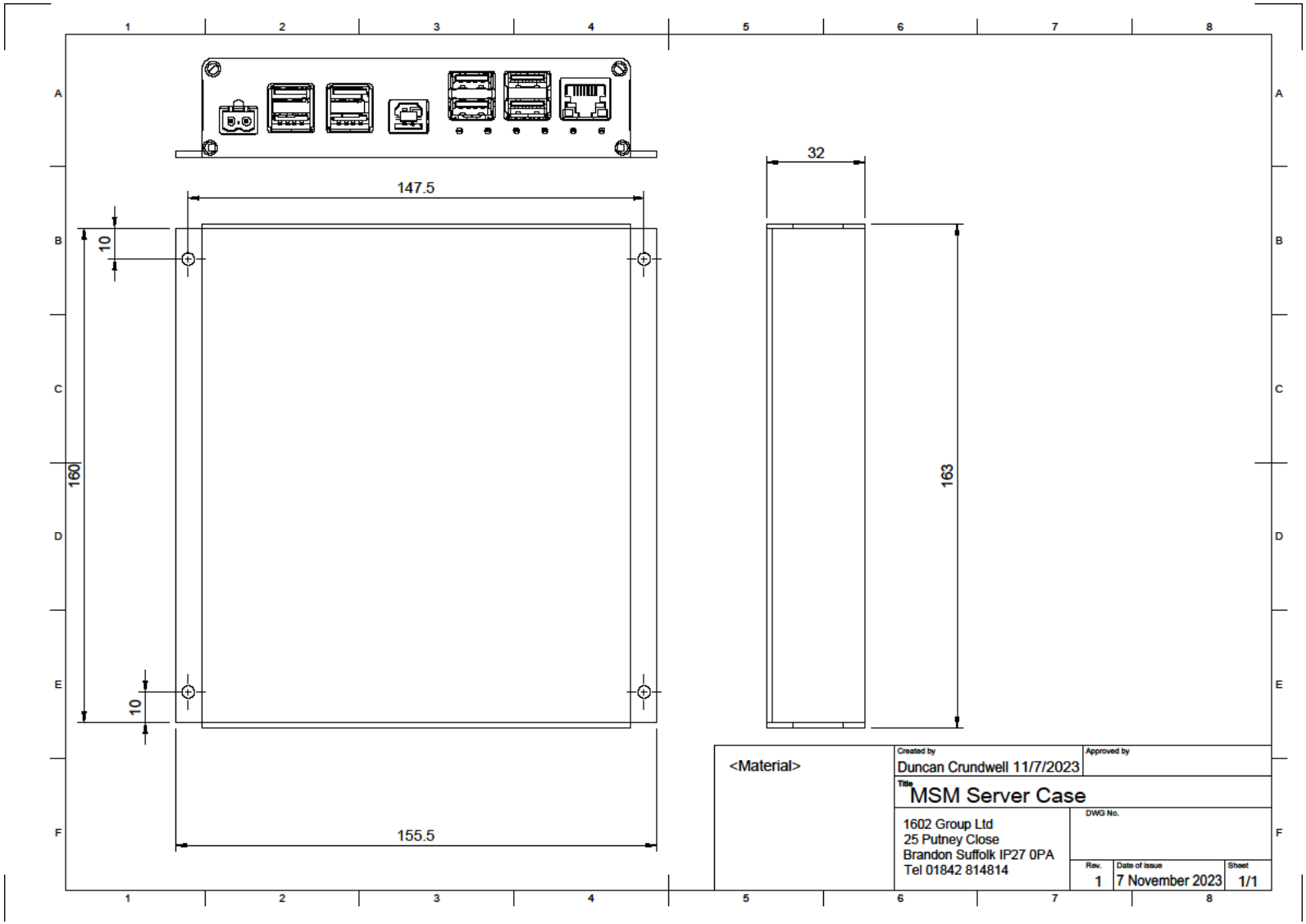
Many of the drivers we use on our systems now have built in load sensing. This can cause LEDs to glow dimly when they should be off. To avoid this problem, we recommend fitting a bypass resistor from the lamp output pin to the LED supply (POS for negative outputs and vice versa). Use the same value resistor as the for current limit resistor.

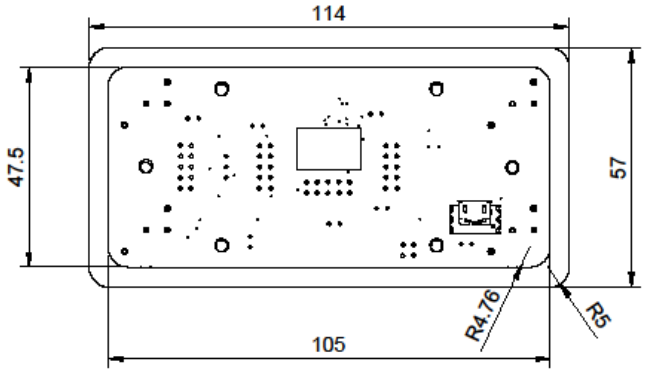


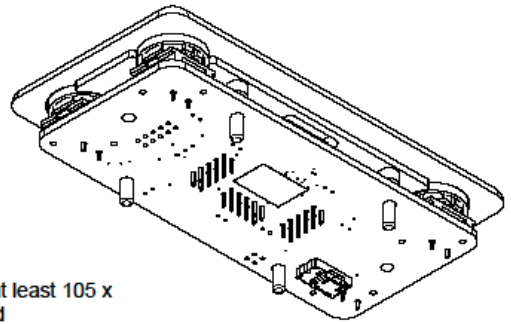
All resistors should be 1/4 Watt or higher power (e.g. 1/3 Watt, 1/2 Watt).

Mechanical Drawings

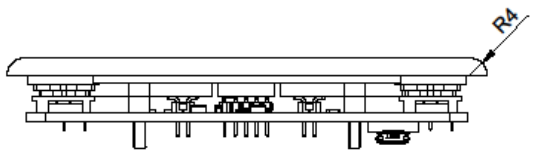


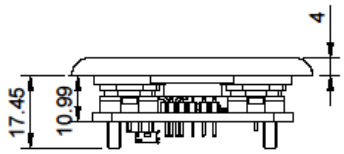

147.5
32
10
160
163
10
155.5
<Material>
Created by
Duncan Crundwell 11/7/2023
Approved by
Title
MSM Server Case
1602 Group Ltd
25 Putney Close
Brandon Suffolk IP27 0PA
Tel 01842 814814
DWG No.
Rev.
1
Date of issue
7 November 2023
Sheet
1/1



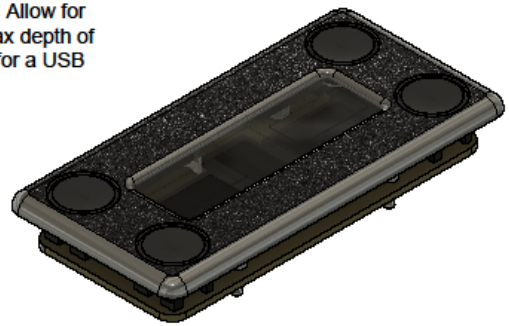


Cutout in console to be at least 105 x 47.5 to clear circuit board





Clearance below face: Allow for fixing brackets to a max depth of 21mm. Cable access for a USB



1602 GROUP

1602 Group Ltd. 25 Putney Close, Brandon, Suffolk IP27 0PA
Tel: 01842 814814

Dept.	Technical reference	Created by	Approved by	
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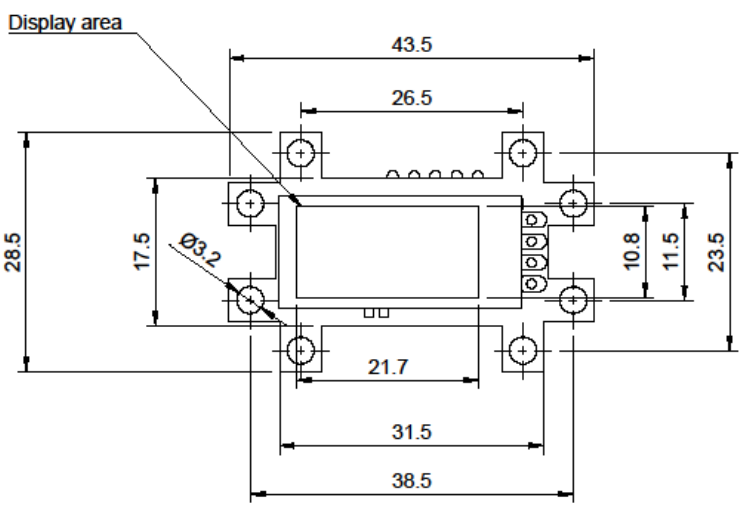
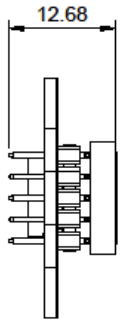
		Document type: Customer Guide	Document status	
		Title: Main Control Panel TFT USB	DWG No.	
			Rev. 1	Date of issue: 15 August 2023 / Sheet 1/1

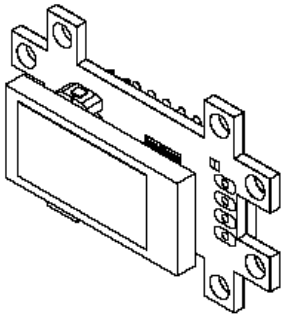




Variants - same hardware:

1. 62313820 Single row of digits

2. 62313821 Double row of digits



Notes:

1. Display area is 21.7 x 10.8mm and is not centred
2. Any of the 8 tabs may be removed to fit. They are provided solely for mounting
3. Do not modify the cicuit board otherwise, it has hidden tracks that will damage it
4. A 4 pin screw terminal on the rear side is used to connect to a USB cable supplied that may be cut shorter if required
5. Total depth from face of display to back of connector 17.5mm
6. A second display may be added inverted to the left to provide two displays close together
7. Displays may be inverted or colour changed in software
8. Observe Anti-Static procedures when storing and installing
9. Carefully remove protective cover with red tab before installing

	Created by: Duncan Crundwell 4/13/2022	Approved by:
	Title: TFT Keyslip Display	
1602 Group Ltd 25 Putney Close Brandon Suffolk IP27 0PA Tel 01842 814814	DWG No.: 62313820-1	
	Rev.: 2 / Date of issue: 23 August 2023	Sheet: 1