Contents

Product Overview

This self-contained device is ready to use. It can be easily attached to the rear surface of most Storm keypads to provide connectivity and communication with USB compatible host systems. Factory configured for standard numeric data entry, this versatile device can also be user programmed to output any supported USB code; making the 450 Series encoder the ideal keypad interface for most applications.

Features

Generic keyboard (HID) device – no additional drivers needed

Factory configured to encode telephone or calculator format numeric keypads

Output code table can be customised using Storm's USB Configuration Utility

Host PC can use the supplied API to control the encoder functions in an application.

Integrated power supply for keypad illumination

450i version provides additional brightness control for keypad illumination

450i version features a piezo sounder for optional key press confirmation or application driven status signal

Simple connection via a USB Mini-B socket

Compact, self contained form factor

Compatible with most Storm 4, 12 and 16 key format keypads

(including Storm 700, 720,1000, 2000, 3000, GFX and PLX product series)

Separate ribbon cable available if you do not wish to plug the encoder directly onto the rear of the keypad.

Product Range and Accessories

Part Number	Description
4500-10	450i Encoder with Buzzer and Illumination Control
4500-00	450 Encoder
4500-01	USB 2.0 Cable MINI-B TO TYPE A, 0.9m
4500-CAB07	Ribbon Cable 0.3 metre for remote connection to 4 way keypad
4500-CAB10	Ribbon Cable 0.3 metre for remote connection to 12/16 way keypad

Note :
These part numbers are for on line ordering directly from Storm Interface.
When bought through broadline distribution they have an additional suffix to allow for distributor specific labelling/marking requirements e.g.

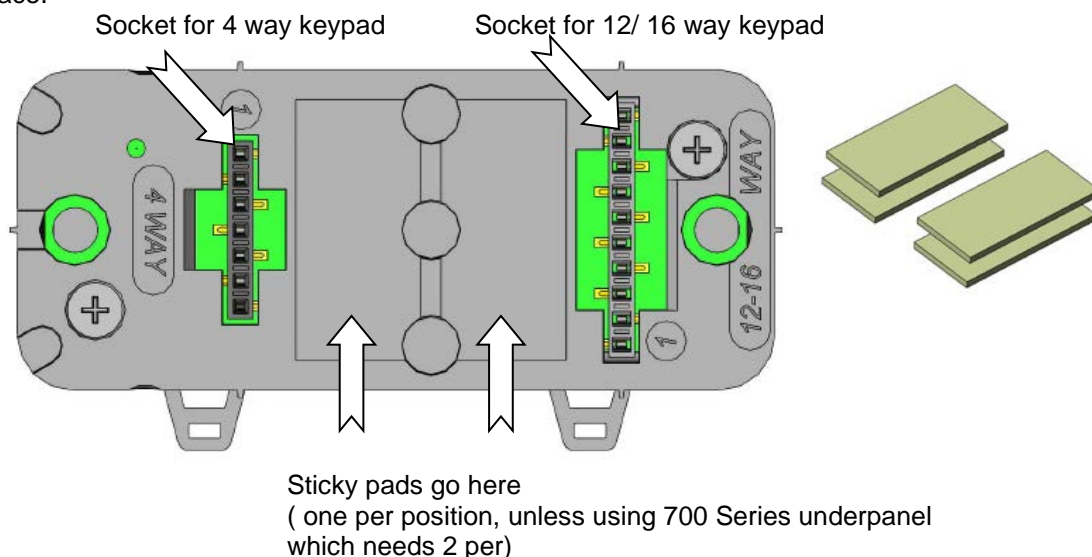| 4500-102	450i Encoder with Buzzer

Quickstart Guide

Before starting make sure that you have :

- The encoder

- A compatible Storm keypad.

- A USB mini-B cable between your keypad and the host computer.

- A panel with the correct cutout for your keypad

- A copy of the configuration utility if you want to customise the configuration

Installation

- Ensure your computer is powered up before connecting the encoder.

- Note that there are two different sockets for the keypad connection, depends if a 4 way or 12/16 way keypad is being used. Make sure that the correct socket is used before using the sticky pads to fix the encoder in place.

Socket for 4 way keypad   Socket for 12/ 16 way keypad

Sticky pads go here
(one per position, unless using 700 Series underpanel
which needs 2 per)

- Push the encoder onto the keypad pins ; make sure the pad sticks down

- Plug in the mini B USB cable on the side of the encoder

One Time Only Initialisation

This initialisation process must be completed the first time you turn it on. The encoder has to recognise the keypad, and you have to select the layout that matches the keypad layout.

a) **PRESS AND HOLD** the bottom right hand key on the keypad – this tells the encoder which keypad is connected

b) Connect the encoder cable to the pc

c) **RELEASE KEY IF** you want function key (4 way) / telephone layout (12/16 way) code table

    or

d) **KEEP THE KEY PRESSED FOR 10 SEC IF** you want cursor (4 way) / calculator (12/16 way) code table

Now check that you are getting the correct characters on screen. If you need to reconfigure the encoder you can change the code table (or reset to a pre-loaded code table) with the USB Configuration Utility from www.storm-interface.com

F.A.Q's

Does this encoder need a special driver ?	No – it works with the standard USB keyboard driver.
Does the utility work on any pc ?	At present it does not run on Linux or Mac OS. The utility requires Windows XP or later.
What's the USB connection ?	Mini-B socket
Do I need to use the sticky pads ?	These are included to retain the encoder in service.
What custom USB codes can I assign ?	See the code tables on page 11.
What do I do if I have wrongly initialised the product ?	Download & use the config utility to reset defaults.
Why is the socket longer than the pinstrip on my keypad?	The end pins power the 720 illuminated keypads.
Can I control this from a host application ?	Yes – the commands are listed in the API reference.
Can the host activate the keypad illumination to prompt for user input ?	The Encoder API includes an 'LED Brightness Command' which enables the host software application to control the keypad illumination. For example, the illumination setting can be changed from 0 (keypad illumination off) to a setting of 9 (full brightness) to indicate to the user that keypad input is required.

Ratings & Performance

Operational temperature	-20ºC to +60ºC
Storage temperature	-20ºC to +70ºC
Humidity	10% to 90% non-condensing
Vibration and shock	ETSI 300 019 5M3
Operating voltage	5V +/- 5% (USB)
Operating current	20mA (excluding keypad illumination current)

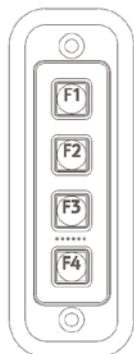|	
Safety	EU Low Voltage Directive
EMC:	Emissions and Immunity: FCC part 15 class A
	EN55022, EN55024
	ESD: Up to +/- 15kV air discharge, +/- 7.5kV contact discharge

EU RoHS

WEEE Directive compliant

Compatible Products

	4 Key	12 Key	16 Key	Note
700 Series	☑	☑	☑	Use additional sticky pads for underpanel fixing of 700 Series
720 Series	☑	☑	☑	720 and 720 illuminated keypads are supported
1000 Series	☑	☑	☑	
PLX Series	☑	☑	☑	
2000 Series	☑	☑	☑	
GFX	☑	☑	☑	
3000 Series	☑	☑	☑	
SF6000			☑	Use remote connection cable. – see page 18 (NB Illumination circuit is separate)
6000			☑	Use remote connection cable – see page 18
3000 Illuminator				Illumination not supported on this model
GFX Illuminator				Illumination not supported on this model
	Use the 7 way socket for 4 key pad	Use the 10 way socket for 12/16 key pad		

Keypad Layouts
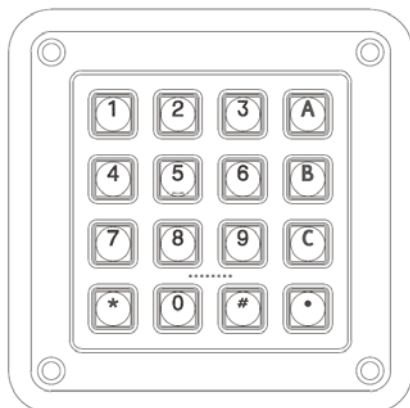
Keypad Layouts	Keypad Layouts
Default Code Table (US English)	Alternate Code Table (US English)

4-Way Function
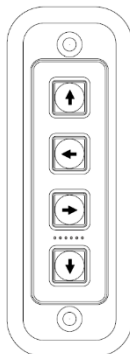
4-Way Cursor

12-Way Telephone

12-Way Calculator
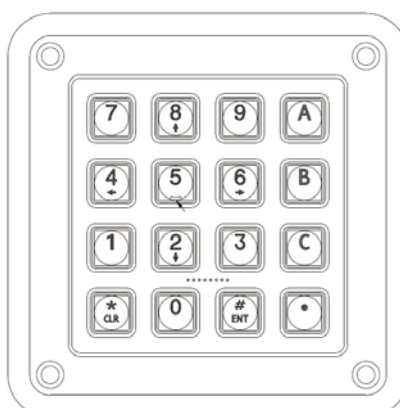
16-Way Telephone

16-Way Calculator

Default Code Tables   (remember host set to UK English gives £ instead of #)

Row	Column	4 way codes Function (hex)	12 way code Telephone(hex)	16 way code Telephone(hex)
A	1	F1 (3A)	1 (1E)	1 (1E)
B	1	F2 (3B)	4 (21)	4 (21)
C	1	F3 (3C)	7 (24)	7 (24)
D	1	F4 (3D)	* (E1, 25)	* (E1, 25)
A	2	-	2 (1F)	2 (1F)
B	2	-	5 (22)	5 (22)
C	2	-	8 (25)	8 (25)
D	2	-	0 (27)	0 (27)
A	3	-	3 (20)	3 (20)
B	3	-	6 (23)	6 (23)
C	3	-	9 (26)	9 (26)
D	3	-	# (E1, 20)	# (E1, 20)
A	4	-	-	A (04)
B	4	-	-	B (05)
C	4	-	-	C (06)
D	4	-	-	. (37)

Alternate Code Table   (to get the arrow keys on a 12/16 way keypad then switch NumLock off)

Row	Column	4 way code Cursor (hex)	12 way code Calculator (hex)	16 way code Calculator (hex)	Output for 12/16 way with NumLock off
A	1	↑ (52)	7 (5F)	7 (5F)	HOME
B	1	← (50)	4 (5C)	4 (5C)	←
C	1	→ (4F)	1 (59)	1 (59)	END
D	1	↓ (51)	* (E1, 25)	* (E1, 25)	*
A	2	-	8 (60)	8 (60)	↑
B	2	-	5 (5D)	5 (5D)	
C	2	-	2 (5A)	2 (5A)	↓
D	2	-	0 (62)	0 (62)	
A	3	-	9 (61)	9 (61)	PgUp
B	3	-	6 (5E)	6 (5E)	→
C	3	-	3 (5B)	3 (5B)	PgDn
D	3	-	# (E1, 20)	# (E1, 20)	#
A	4	-	-	A (04)	A
B	4	-	-	B (05)	B
C	4	-	-	C (06)	C
D	4	-	-	. (37)	.

Configuration Utility

To customise the output codes just download and install the Configuration Utility from *www.storm-interface.com*
This lets you do the following :-

Scan the encoder in order to	Confirm the encoder is connected
	Show which version of firmware is installed
	Show which keypad is set (4, 12 or 16 key)
	Show which code table is selected (default, alternate or customised)
And also	Change the keypad setting
	Change the selected code table
	Change the buzzer volume (450i only)
	Change the brightness on illuminated keypads (450i only)
	Self test the encoder
For re-legendable keypads	Customise the code table by assigning a USB code to each key
	Add a modifier in front of each USB code
	Save this configuration
	Export or Import configuration files
For maintenance purposes	Update the encoder firmware if a new version is released
	Restore all settings to original factory defaults.

API

To allow a host application to control the USB encoder the available commands are listed in the API Documentation.

Product Dimensions

|	
Overall dims	77mm x 39mm x 25mm, 30 grams
Packed dims	124mm x 52mm x 40mm, 50 grams
Included parts	Qty 4 sticky pads, Installation sheet

Cables

Depending on your installation you may require either a straight or an angled cable, with latching mini B USB connector.   If you use an angled cable then you will be able to secure the cable to the encoder as below.
Note : Angled Mini B cables are available with 2 possible connectors – see picture below.

Encoder on 4 way keypad

Encoder on 12 way keypad
(order pn 4500-01 from Storm)
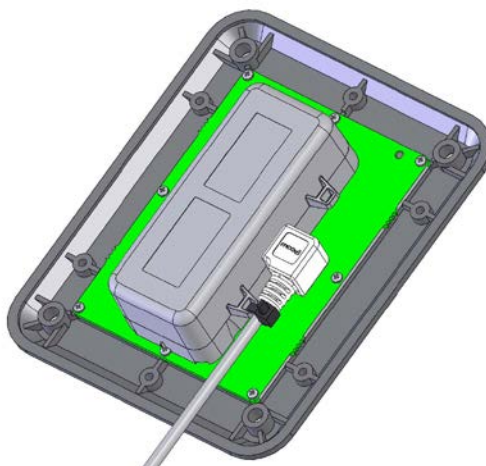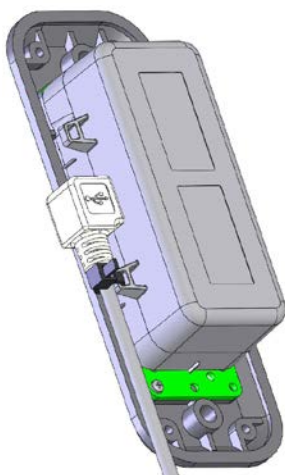
If you wish to install the encoder remote from the keypad then you will need an interconnection cable
Cable details as shown below (or order 7 way cable PN 4500- CAB07 ,10 way cable PN 4500-CAB10)

Encoder 4 W PIN	to	4 w keypad PIN	Illuminated version PIN
1			1
2		1	2
3		2	3
4		3	4
5		4	5
6		5	6
7			7

Molex KK 0.1" Pitch Socket 2695 Series Pitch Socket -connect to keypad

Molex KK 0.1" Pitch PIN Headers -connect to 450 encoder

	Encoder 12/16 PIN	to	12/16 keypad PIN	Illuminated version PIN	SF6000 Series Matrix Keypad PIN	6000 Series Matrix Keypad PIN
						1
	1			1		2
R1	2		1	2	1	3
R2	3		2	3	2	4
C1	4		3	4	3	5
C2	5		4	5	4	6
C3	6		5	6	5	7
C4	7		6	7	6	8
R4	8		7	8	7	9
R3	9		8	9	8	10
	10			10		11
						12
						13

Installation – variable brightness

If you need to vary the brightness in service then you will need to use the remote cable (previous page) and fit a pot in line for the pin 10 connection line. Set the brightness to maximum using the Utility software, then you can use the pot to dim it.

Note:
LED illumination on
450 series encoder should
be set to maximum.

Cut last wire, separate,
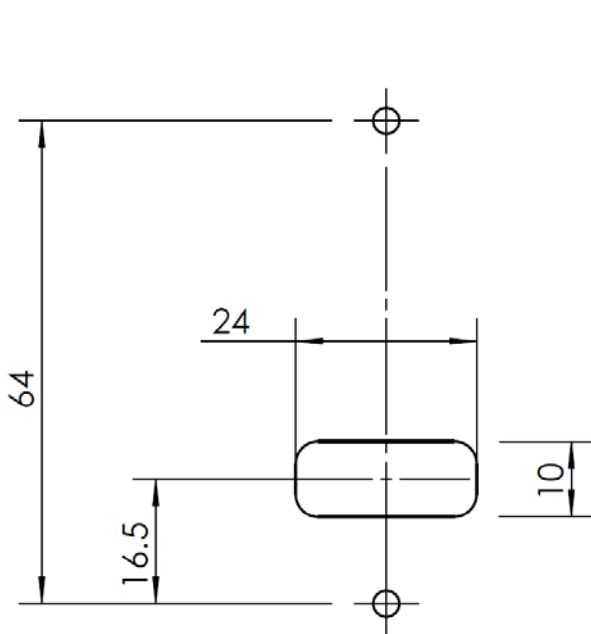strip ends and solder to
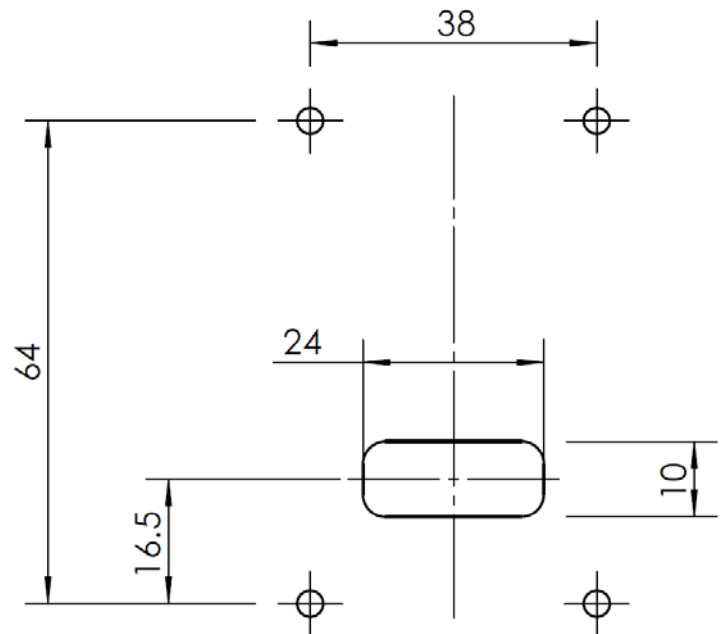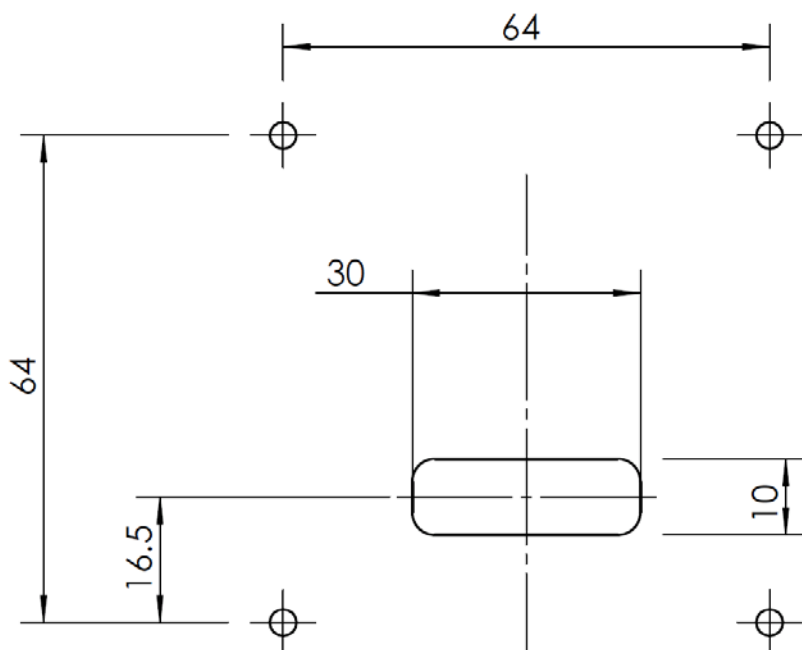variable resistor pot
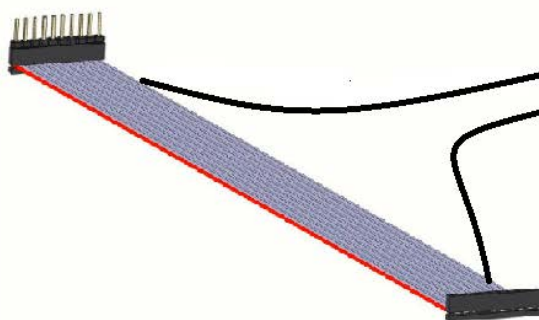
RS Stock No.: 179-0661

RS Stock No
179-0661

Panel Cutout Drawings

Surface Fixing of Keypads : 700 Series. 720 Series   Both products use the same panel cutout detail.

4 WAY PANEL FRONT MOUNTED

12 WAY PANEL FRONT MOUNTED

16 WAY PANEL FRONT MOUNTED

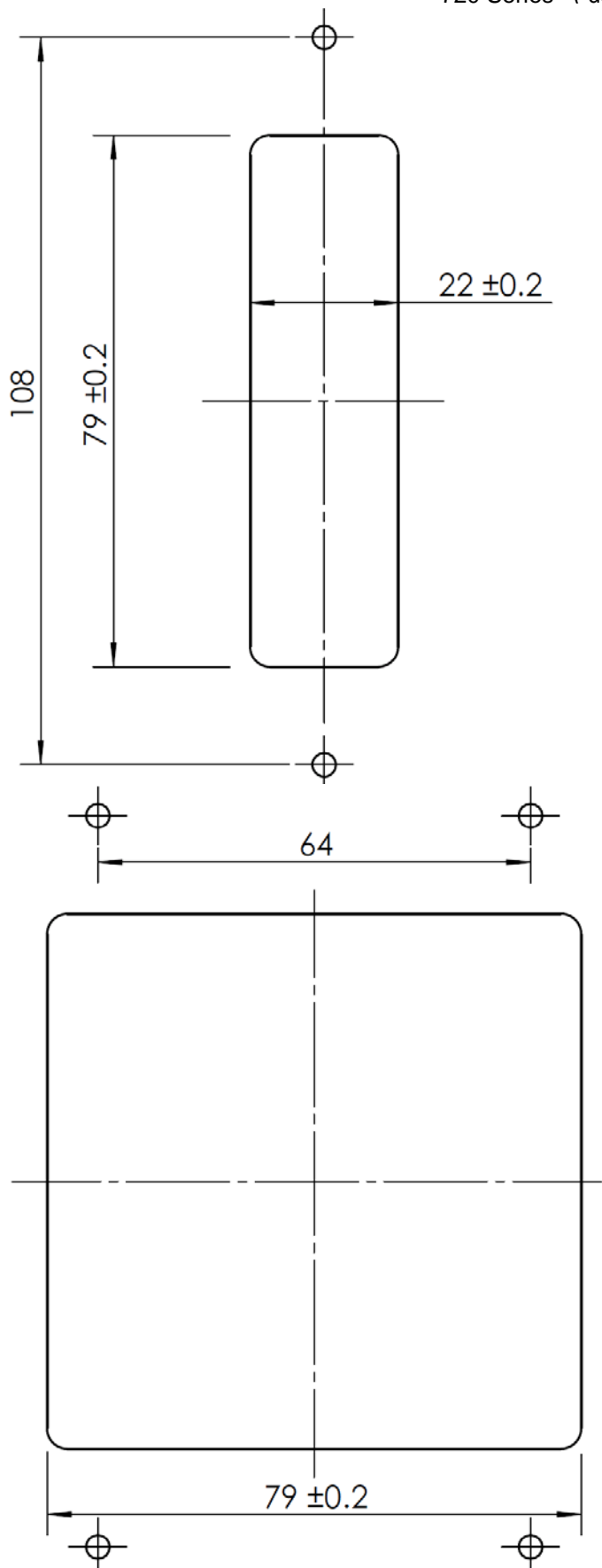PANEL DETAILS FOR
700 AND 720 SERIES
FRONT FIXING

ALL DIMS IN MM
R3 IN CORNERS

CLEARANCE HOLES
DIAMETER 3.5 FOR STUDS

Panel Cutout Drawings

Underpanel Fixing of Keypads :   700 Series. (4 way uses fix kit 7004CL0, 12/16 way uses fix kit 7012CL0)
720 Series   (uses fixing kit pn 7204CL0, 12/16 way uses fix kit 7212CL0)

22 ±0.2

79 ±0.2

108

64

79 ±0.2

38

60 ±0.2
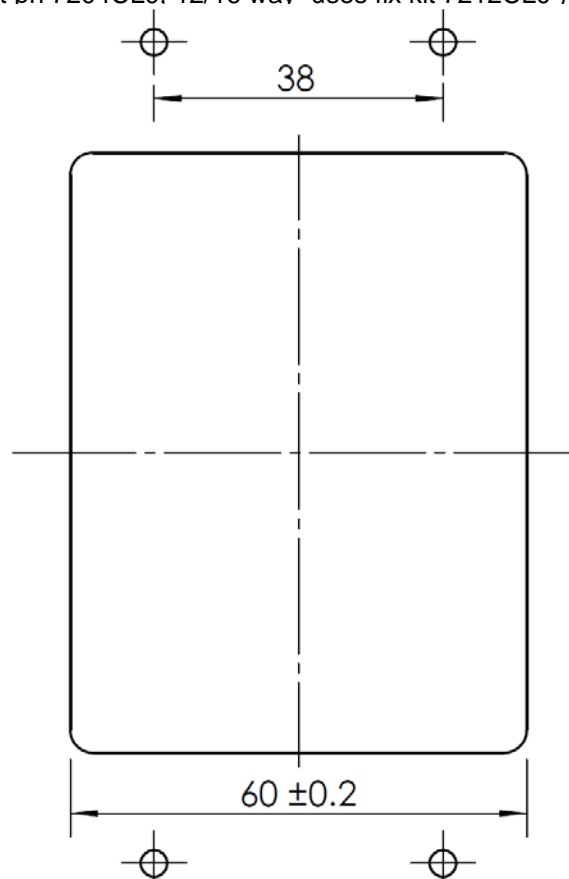
PANEL DETAILS FOR
700 AND 720 SERIES
UNDERPANEL FIXING

4, 12 AND 16 WAY
KEYPADS
MAKE SURE TO USE THE
CORRECT FIXING CLIPS
FOR PRODUCT

ALL DIMS IN MM
R3 IN CORNERS
M3 STUDS OR SIMILAR

Panel Cutout Drawings

Surface Fixing of Keypads : 1000 Series, 2000 Series, PLX Series
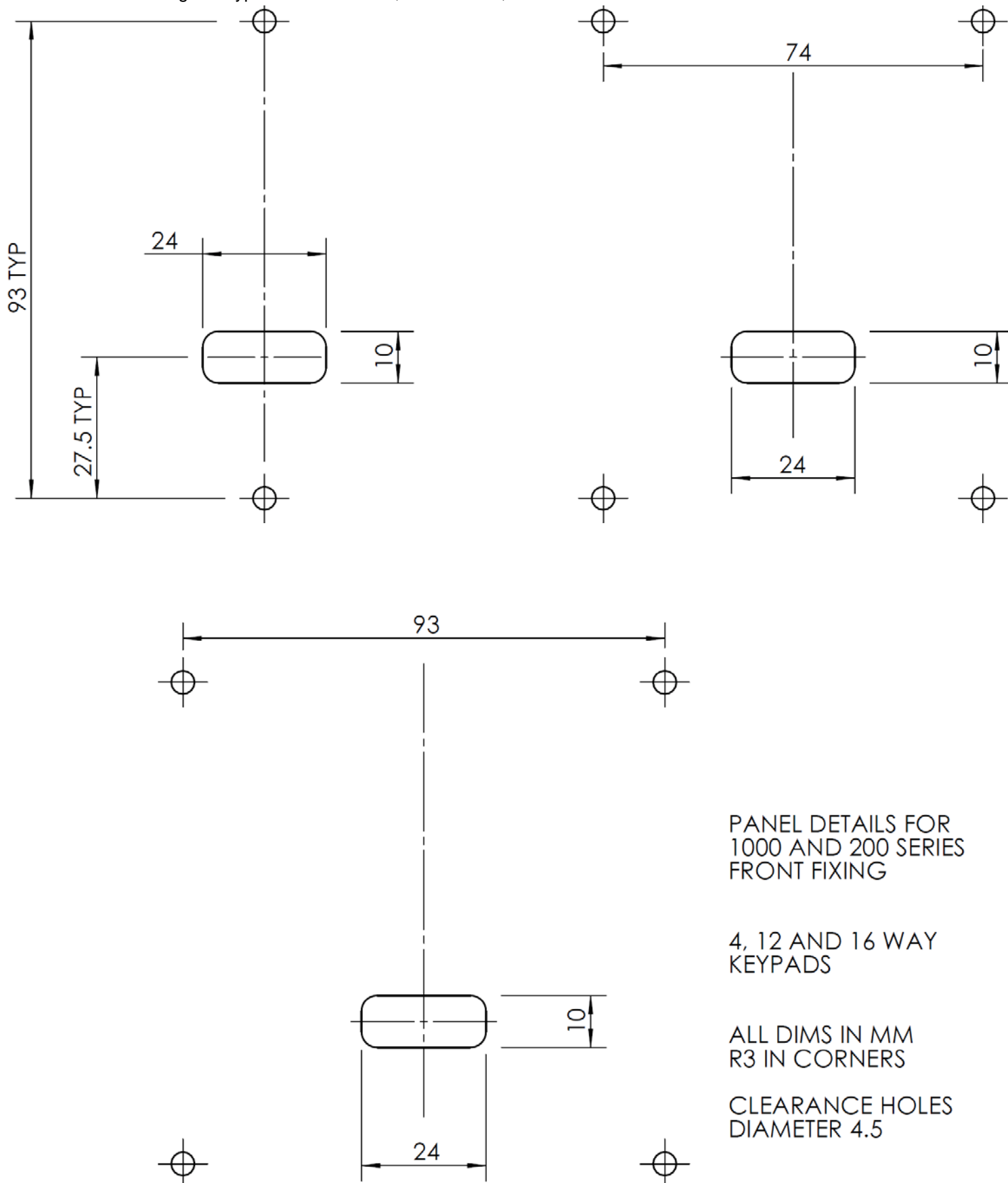
PANEL DETAILS FOR
1000 AND 200 SERIES
FRONT FIXING

4, 12 AND 16 WAY
KEYPADS

ALL DIMS IN MM
R3 IN CORNERS

CLEARANCE HOLES
DIAMETER 4.5

Panel Cutout Drawings

Underpanel Fixing of Keypads : 1000 Series, 2000 Series, PLX Series.   Use M3 CD weld studs or similar
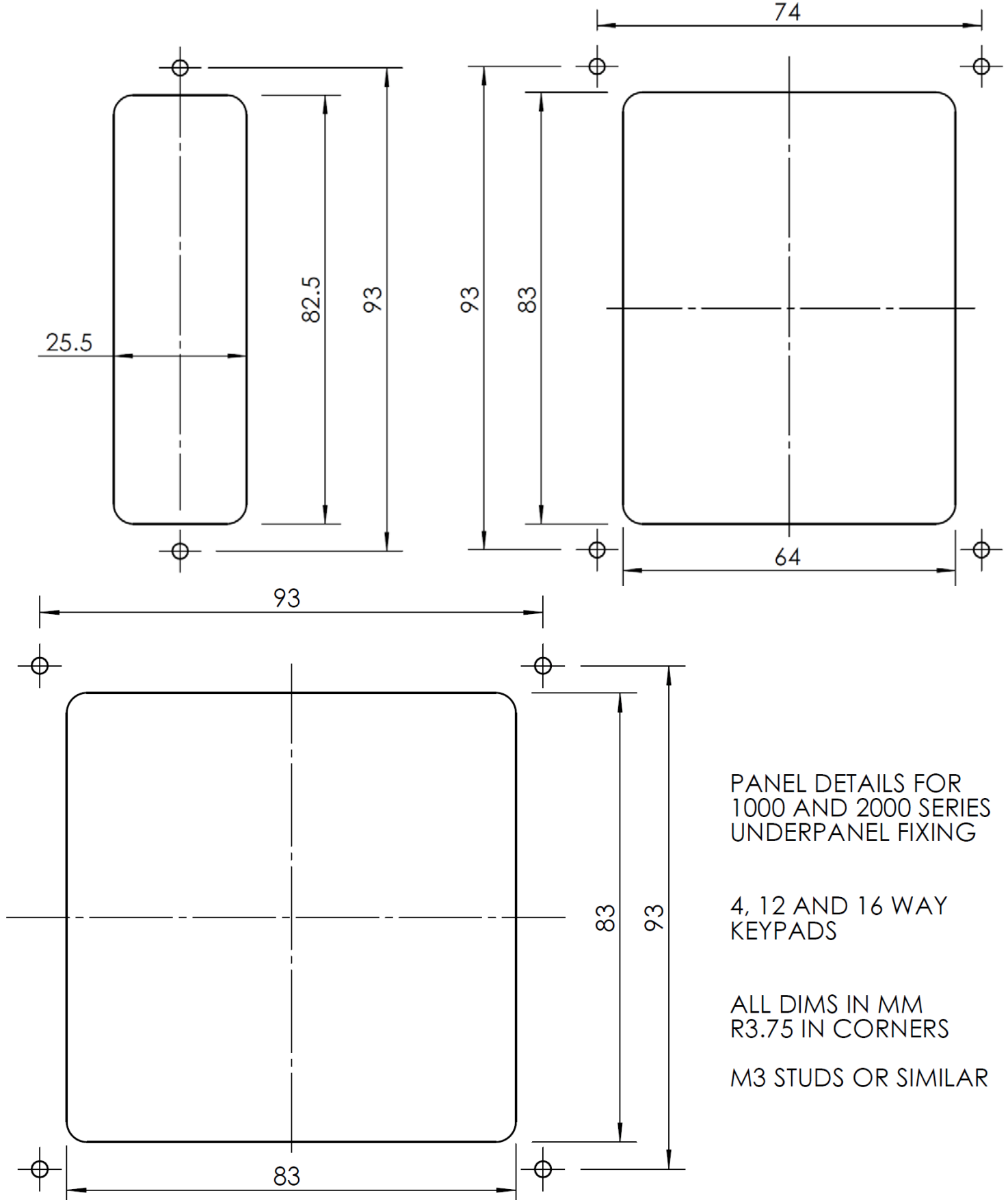
PANEL DETAILS FOR
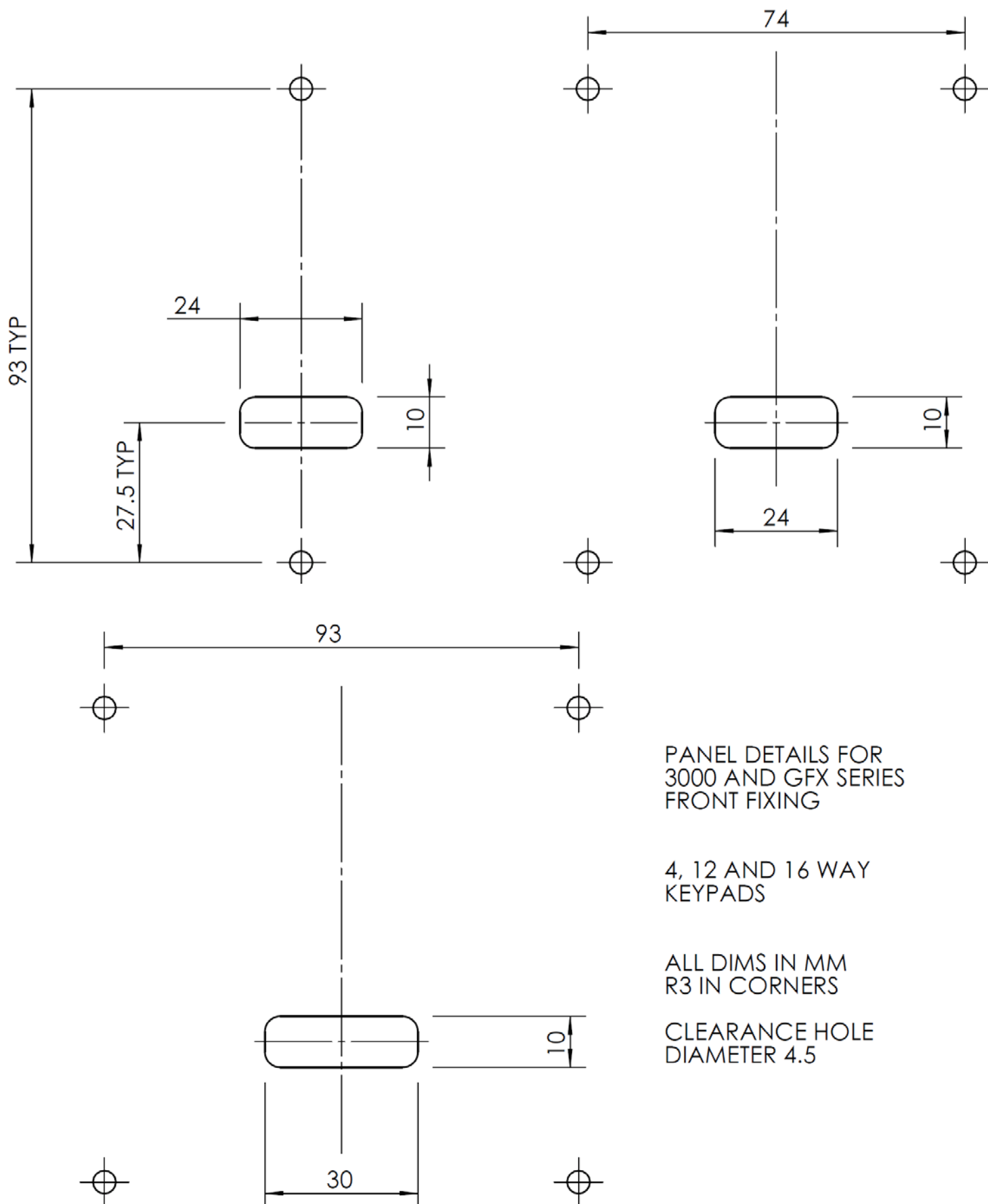1000 AND 2000 SERIES
UNDERPANEL FIXING

4, 12 AND 16 WAY
KEYPADS

ALL DIMS IN MM
R3.75 IN CORNERS

M3 STUDS OR SIMILAR

Panel Cutout Drawings

Surface Fixing of Keypads : 3000 Series, GFX Series

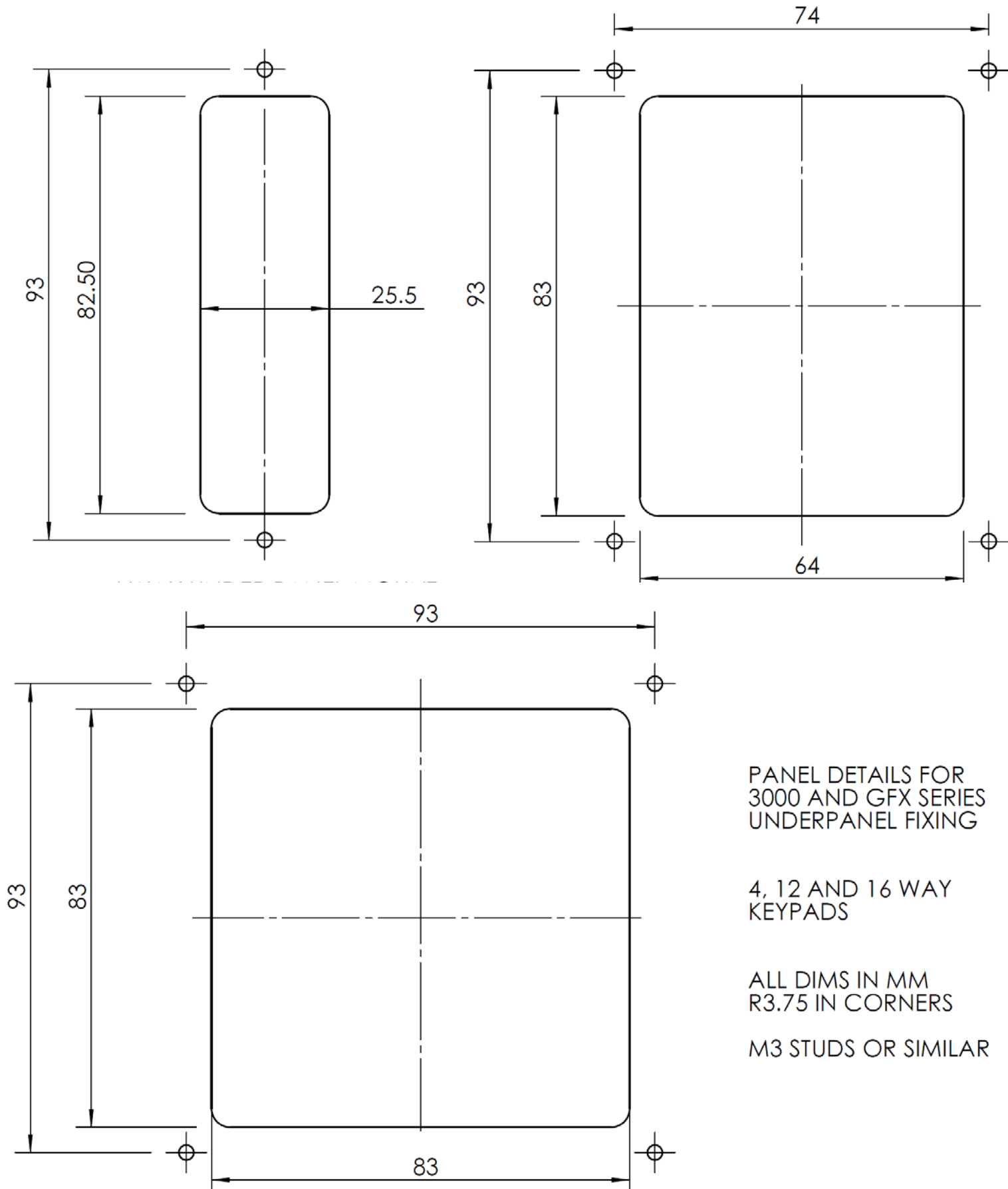PANEL DETAILS FOR
3000 AND GFX SERIES
FRONT FIXING

4, 12 AND 16 WAY
KEYPADS

ALL DIMS IN MM
R3 IN CORNERS

CLEARANCE HOLE
DIAMETER 4.5

Panel Cutout Drawings

Underpanel Fixing of Keypads : 3000 Series, GFX Series,

PANEL DETAILS FOR
3000 AND GFX SERIES
UNDERPANEL FIXING

4, 12 AND 16 WAY
KEYPADS

ALL DIMS IN MM
R3.75 IN CORNERS

M3 STUDS OR SIMILAR

Copyright Notice

Change History

USB Encoder Firmware	Date	Version	Details	
	1 Aug 13	8v02	First Release	
bcdDevice value 0x0200	20 Aug 13	8v03	Disable USB stack serialisation	
	12 Nov 13	8v04	Improve Brightness Control.	
	03 Mar 17	8v05	Improve stability	
	13 Dec 17	8v06	Improved recovery process, if USB state is in other state then enumerated.	
	20 Jan 18	8v07	Windows 10 update. Recovery from MCU going to sleep mode. This was part of USB recovery process.	
	30 May 18	8v08	Disable low power mode (this caused occasional missed key presses when MCU is waking up from suspend state)	
Change to 48 Pin TI chip bcdDevice value 0x0233	04 Apr 24	8v11	First Release with new chip	
	05 Jun 24	8v12	Increase timeout to allows customer to change keypad layout. Change from 1 sec to 10 sec	

Technical Manual	Date	Version	Details	
	01 Aug 13	1.0	First Release	
	12 Aug 13	1.02	Alternative Code table : Outputs with Numlock clarified. Also changed in French version Checked some USB codes in the full tables. Removed Insulation Breakdown spec (error)	
	01 Oct 13	1.03	Add section about the API	
	12 Nov 13	1.05	Software update to 8v04	
	02 Nov 15	1.1	API added, plus addition of LED & buzzer control in API command set.	
	06 May 16	1.2	Fixed Molex pn ref for connection cable	
	13 Feb 17	1.3	Added info for ribbon cables for remote install, software update to 8v05.	
	22 Jun 17	1.4	added SF6000 series pinout connection	
	01 Jun 18	1.5	Added firmware update notes.	
	02 Dec 20	1.6	Added 6000 series pinout connection	
	26 Apr 21	1.7	Added note on FAQ p4 : Host turning on backlight	
	01 Jul 23	1.8	FW update for new TI micro / Utility updated	
	04 Apr 24	1.9	Added new chip version info	
	15 Aug 24	2.0	Split out instructions for Utility / API into new docs	