
Bharat Heavy Electricals Limited

HIGH PRESSURE BOILER PLANT , TIRUCHIRAPPALLI 620 014.

CONTROLS AND INSTRUMENTATION

TECHNICAL SPECIFICATION

FOR

MEMBRANE KEY PANEL, DISPLAY MODULE AND ACCESSORIES FOR MICRO PROCESSOR BASED GRAVIMETRIC FEEDER CONTROL

SPECIFICATION NO.: TDC: TCI:307/REV 06

06	28.09.2020	Keyboard type changed to Non-Tactile	**[SKS]**	**[KV]**	**[AKP]**
05	09.03.2019	BOM Updated & Keyboard type changed to tactile	**-/sd**	**-/sd**	**-/sd**
04	05.06.2009	BOM for Key panel communication module revised.	**-/sd**	**-/sd**	**-/sd**
03	30.06.2008	Feedback on components incorporated.	**-/sd**	**-/sd**	**-/sd**
02	27.03.2008	Component changes incorporated	**-/sd**	**-/sd**	**-/sd**
01	30.11.2007	Component changes incorporated	**-/sd**	**-/sd**	**-/sd**
00	22.06.2007	Initial release	**-/sd**	**-/sd**	**-/sd**
REV	**DATE**	**DESCRIPTION**	**PREPARED**	**CHECKED**	**APPROVED**

1.0 (A) SCOPE:

The following items and activities shall constitute the scope of supply:

1.1 40x2 Vacuum Fluorescent display module *

1.2 12V Power Supply Module *

1.3 24V Power Supply Module *

1.4 Custom built membrane key panel *

1.5 Key panel communication Module *

1.6 Testing of assembled modules

The following shall be applicable for items (1.4) & (1.5)

PCB artwork design

Solder mask with component legend printing

PCB marking and population with the components

Protective conformal coating

Any other items and activities those are necessary to manufacture and supply the modules meeting all functional requirements and the system complete.

(B) Exclusion:

Application program for communication between the keyboard and CPU.

* Quantity as per enquiry

2.0 GENERAL REQUIREMENTS:

2.1 The make and model of various components are indicated in the bill of materials. Any change suggested by the vendor has to be indicated in the offer itself. Deviation, if any will not be accepted after the placement of purchase order (PO).

2.2 All components shall be of **industrial grade**. Components shall be test screened before populating.

2.3 Power supply de-coupling capacitors shall be provided to IC's as per standard practice.

2.4 Standard industrial PCB manufacturing and populating guidelines are to be followed.

2.5 PCB shall have BHEL emblem and name of module along with vendor code. This will be specified after placement of PO.

2.6 Films for PCBs. Component side, solder side negatives shall be furnished after placement of PO.

3.0 DESCRIPTION OF MODULES:

3.1 VACUUM FLUORESCENT DISPLAY (VFD) MODULE

- 40-character x 2 line VFD Module
- Make: Futaba, Part No. M402SD07GR/M402SD64AA

3.2 12 V POWER SUPPLY MODULE SMPS-1

The 12 V power supply module shall be used to power the CPU (supplied by others) in the GFC panel. The detailed specification is given in Annexure-2.

3.3 24 V POWER SUPPLY MODULE SMPS-2

The 24V power supply module shall be used to power the I/O rack module (supplied by others) in the GFC panel. The detailed specification is given in Annexure-2.

3.4 CUSTOM BUILT MEMBRANE KEY PANEL

The Custom Built membrane key panel is the user interface device and is used to feed setup data and program parameters to the system. The detailed specification is given is Annexure-3

3.5 KEY PANEL COMMUNICATION MODULE

The Key panel communication module is the communication bridge between the CPU and the key-panel, display module. The required communication is established by means of RS232 serial link. The module is to be designed for 24V DC input power supply.

The following documents are attached for further understanding of the above modules.

- Bill of materials for Key panel communication module - Annexure-1
- Specification details of power supply modules, (3.2) & (3.3) - Annexure-2
- Specification details of custom built membrane key panel with display window for VFD - Annexure-3

4.0 QUALITY REQUIREMENTS:

4.1 The vendor shall get the vendor-quality plan, inline with BHEL quality plan format, approved by BHEL.

4.2 One complete set of all items shall be manufactured, populated, tested and shall be informed to BHEL for prototype inspection. After getting approval for prototype module, further manufacturing of balance quantity shall be done. This should be offered positively on or before 20 days from the date of the PO. The CPU required for conducting the testing of the module shall be provided by BHEL. This clause is applicable only to first supply pertaining to any vendor.

4.3 BHEL will carry out final inspection of this module.

5.0 DOCUMENTATION:

5.1 Along with offer.

- Compliance to each clause of this specification and quality requirements.
- Compliance to BOM clearly indicating make, tolerance and quantity for the offered modules.

5.2 In the event of PO

- PCB artwork drawing & component layout drawing.
- Schematic and component layout drawings.
- Bill of material indicating make and quantity.
- Quality plan for the scope of items as indicated in (1.0).

Vendor shall submit above documents in soft copy for BHEL's approval. Documents shall be furnished within one week from the date of PO.

6.0 IPR REQUIREMENTS:

The technology forms part of product/service patented by BHEL. The information contained in this enquiry specification is provided by BHEL to enable the vendors to work out their offers and submit them to BHEL. The vendors are advised not to use the information contained in this enquiry or provided by BHEL in any of the subsequent interactions for any other purpose whatsoever without the express written permission from BHEL. The vendors shall never use the information to infringe upon BHEL RIGHTS or detrimental to BHEL's interests. The vendors shall return all the documents along with their quotation / regret letters.

The vendors shall not divulge any information contained in the vendor documents or otherwise provided by BHEL to any third party without express written consent from BHEL.

"BHEL RIGHTS" shall mean the proprietary technology owned by BHEL pertaining to the product / process, including but not limited to patents, patent applications, confidential information, copyrighted information including trademarks and any trade secrets used in the manufacturing / executing and supply / rendering of the product / service.

7.0 GENERAL INSTRUCTIONS:

7.1 Vendor to check the receipt of complete documents referred as enclosures in the relevant clause of this specification. In the event of PO, the entire specification will form part of purchase order for compliant during execution.

7.2 Deviation if any, shall be clearly brought out in the “Deviation Schedule” (enclosed). Otherwise it will be construed that the vendor is fully complying with the specification.

7.3 The vendor is advised to promptly clarify with BHEL any issue of technical ambiguity or non-clarity.

8.0 SPECIAL INSTRUCTIONS TO VENDOR:

8.1 Vendor shall follow BHEL specification BOM and drawings for inspection. Deviation, if any will not be accepted after placement of PO.

8.2 Nothing in this specification shall be construed to relieve the vendor from his responsibility. The specification covers briefly the requirements of the module. It is the responsibility of vendor to take care of other basic and essential requirements to manufacture a quality product.

Annexure-1

BOM FOR KEY PANEL COMMUNICATION MODULE

RESISTORS:

S. N	LEGEND	QTY	DETAIL	DESCRIPTION	Make
01	R1, R11, R12, R13, R14, R15,R16, R17, R18	9nos.	10 K	0.25 watt, MFR 1% 50ppm	Philips/Keltron/AEC /Walsin/Vishay/Thermax/MFR/Yageo
02	R2, R3, R4, R5, R6, R7, R9,R10	8 nos.	1.0 K		
03	R8	1 no.	560 Ohms		

SMD CAPACITORS:

04	C1, C2, C3, C4, C5, C8	6 nos..	1µF/ 35V	Tantalum , +/- 10% tolerance	(Philips / Samsung / AEC / Advance Electronics / Deawoo / AVX/Vishay/Kemet/Multicomp/Walsin)
05	C6, C7	2 nos.	150 pF/ 63V	Ceramic, +/- 20% tolerance	
06	C9, C12, DC2-DC8, DC10, DC11	11 nos.	0.1µF/ 63V	Ceramic, +/- 20% tolerance	
07	C10, C11	2 nos.	10µF/ 35V	Tantalum, +/- 10% tolerance	

INDUSTRIAL GRADE IC's:

08	U1	1 no.	MAX 232	16 pin DIP	(National / Texas / Motorola / Harris / Philips / Linear Technology / SGS Thomson / RCA / NEC / Fairchild / OKI/ Sprauge/Cipress semi/Pericom/CDT/ Maxim/ATMEL/Microchip technology)
09	U2	1 no.	89C668HBA/ AT89C51RD2-SLSUM	44 PIN PLCC	
10	U3, U4, U5	3 nos.	74FCT373	20 PIN SOIC	
11	U6	1 no.	74FCT245	20 PIN SOIC	
12	U7	1 no.	74AC138	16 PIN SOIC narrow	
13	U10, U11	2 nos.	74LS00	14 PIN SOIC narrow	
14	U8	1 no.	SMD Oscillator 20Mhz	F3340R/ SG710PHK	FOX /SEIKO EPSON

DIODE:

15	D1	1 No.	1N5059	Controlled Avalanche Sinterglass Diode Package : SOD57	Philips/ Vishay/Multicomp

MISCELLANEOUS:

16	U9/U12	1 No.	DC-to-DC Converter 24VDC to 5VDC	AIMTEC make, Part No. AM5T-2405SZ; Traco Make, Part No. TEN5-2411	
17	Jumper JP1, JP2, CON4 – 2X1 Header	3 nos.			Berg Stick – Protectron/champion/ FCI/Samtec
18	J1 - 20x2 Header 90 degree	1 no.			Berg Stick – Protectron/champion/ FCI/Samtec
19	CON3 – 10X2 Female Header	1 no.		P9403-20-21	Berg - Protectron/champion/ FCI/Samtec
20	CON5 – 9 Pin 90 deg.Female D-Connector	1 no.			OEN(FCI)/ESSEN/
21	CN1 – 2 Pos. TB	1 no.	740-102		Wago (Cage Clamp)
22	PCB	1no.	FR4 / 1.6mm Thick 35 micron Cu	Size: 57mm(H) x 250mm(W)	Capronics, Anand Electronics/ Cosmic /Meena Ckts/ Prototech / Suitable source of Industrial Grade
23	44 Pin IC Base	1 no.		PLCC 44	Protectron/Champion
24	Aluminium sheet	1 no	S1 grade		Control touch
25	M3x25mm screw CSK Material: MS	As Req d.			
26	Hex. Spacer (without spindle) inner thread size 3mm, height 11mm Material: Brass	4 Nos.			
27	M3x35mm screw CSK Material: MS	As reqd			
28	M3 Nut, Material:MS	As reqd			
29	SMPS-1	1 No.	Traco make	TIS 75-112	
			XP make	DNR60US12	
			Mean Well make	NDR-75-12	
30	SMPS-2	1 No.	Traco make	TIS 150-124	
			XP make	DNR 120LS24 / DNR 120AS24	

			Mean Well make	NDR-120-24	
31	Custom built membrane key panel assembled in aluminium back plate	1 No.	Control Touch		
32	Acrylic coating	As req.			
33	Silica jel	As req.			
34	Thermocol box for keypanel				
35	Packing boxes for PS & Key board.				

Note: All BOM items shall be of Industrial grade.

Annexure-2

(A) 12 VDC Power Supply Module SMPS –1

Preferred make	Traco/Switzerland (part no. TIS 75-112)	XP/ Switzerland (part no. DNR60US12)	Mean Well/Taiwan make NDR-75-12
Input Voltage range **	93 - 132 VAC / 187-264VAC	85 - 264 VAC	90 ~ 264VAC
Input frequency	47- 63 Hz	47- 63 Hz	47 ~ 63Hz
Output	12V DC, 6 A	12V DC, 5 A	12V DC, 6.3A
Input line regulation	± 1 %	± 1 %	±0.5%
Load regulation	± 2 %	± 2 %	±1.0%
Ripple and Noise	< 150 mV P – P	< 150 mV P – P	80mVp-p
Over Voltage protection	Required	Required	Required
Over load protection	Required	Required	Required
Efficiency	≥70 %	≥70 %	≥70 %
Operating temp. range	- 25 º C to + 70 º C	- 25 º C to + 70 º C	- 20 º C to + 70 º C
EMI suppression	EN 55022 – B	EN 55022 – B	EN55032 (CISPR32),
Safety standards and approvals	UL 508	UL 508	UL508,
Mounting	DIN – Rail 35 mm	DIN – Rail 35 mm	DIN – Rail 35 mm
Connections	Screw terminals	Screw terminals	Screw terminals
Packaging	Fully enclosed in box	Fully enclosed in box	Fully enclosed in box

(B) 24 VDC Power Supply Module SMPS-2

Preferred make	Traco/Switzerland (part no. TIS 150-124)	XP/ Switzerland (part no. DNR120LS24)	Mean Well/Taiwan make NDR-120-24
Input Voltage range **	93 - 132 VAC / 187-264VAC	93 - 132 VAC / 186-264VAC	90 ~ 264VAC
Input frequency	47- 63 Hz	47- 63 Hz	47 ~ 63Hz
Output	24V DC, 6 A	24V DC, 5 A	24V DC, 5A
Input line regulation	± 1 %	± 1 %	±0.5%
Load regulation	± 2 %	± 2 %	±1.0%
Ripple and Noise	< 150 mV P – P	< 150 mV P – P	120mVp-p
Over Voltage protection	Required	Required	Required
Over load protection	Required	Required	Required
Efficiency	≥70 %	≥70 %	≥70 %
Operating temp. range	- 25 º C to + 70 º C	- 25 º C to + 70 º C	- 20 º C to + 70 º C
EMI suppression	EN 55022 – B	EN 55022 – B	EN55032 (CISPR32),
Safety standards and approvals	UL 508	UL 508	UL508,
Mounting	DIN – Rail 35 mm	DIN – Rail 35 mm	DIN – Rail 35 mm
Connections	Screw terminals	Screw terminals	Screw terminals
Packaging	Fully enclosed in box	Fully enclosed in box	Fully enclosed in box

Annexure – 3

Specification for custom built membrane key panel with display window for VFD

Module and LEDs.	All the connections shall be terminated on flex tail.
Size of key panel	300mm(W) x 260mm(H)
Number of keys	32 nos. (8x4 matrix)
Type of key	Non-Tactile type
LEDs	9 nos , 3mm size
Flex tail Length	180 mm
Termination	2 nos. Single row 0.1” pitch female
Connectors. (Berg)	12+1(polarity) position for 8x4 matrix for 32 keys and one 18+1(polarity) pin for 9 LEDs . As per the enclosed Drawing No. 1
Colour Scheme & Key Sizes:	As per the enclosed Drawing No. 2
Display Window	Should have suitable filter for green color VFD Dimensions as per the enclosed Drawing No. 2
Mounting	Sticking with self-adhesive on a suitable Aluminium plate of 1.5mm thickness. As per Drawing No.3
Electrical	
Switch resistance	Less than 100 ohms
Operating voltage	24 V DC maximum
Operating current	30 mA maximum
Contact bounce	Less than 10ms
Operating force	2 ounces
Life	2 million operations,
Certificate to be enclosed Along with quotation.	
Switch and matrix connection	As per the enclosed Table 1 & Table 1A
Switch matrix and LED connections	As per the enclosed Drawing No.1
Operating temperature	-40 deg C to +70 deg C
Dielectric withstand capacity	250 V AC @ 50Hz
Preferred make	Control Touch / Pune

Table No.1: Switch Connections

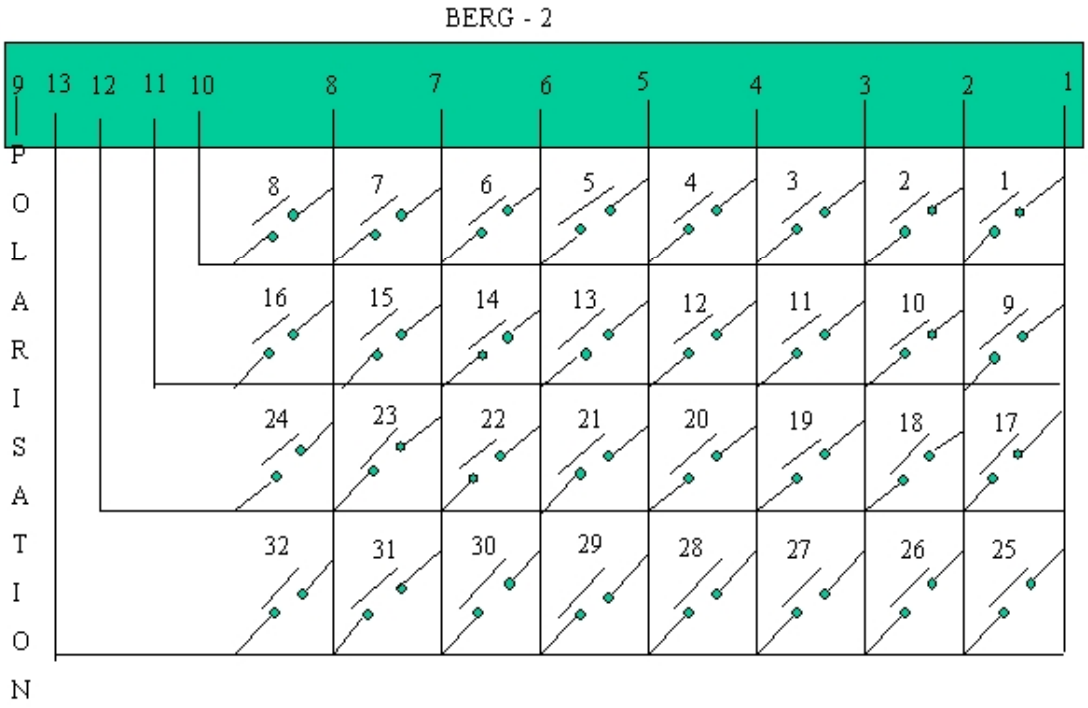
Key Details

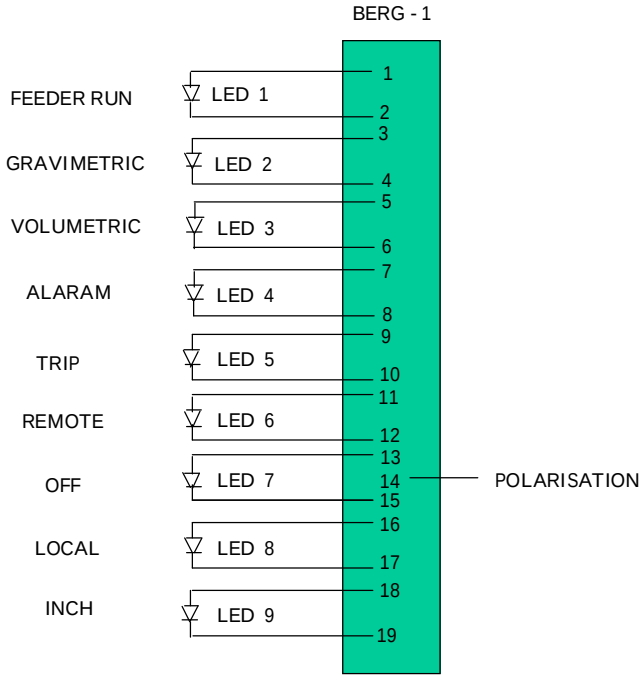
S.No.	Key number	Key description
01	1	Numeric 1
02	2	Numeric 2
03	3	Numeric 3
04	4	Numeric 4
05	5	Numeric 5
06	6	Numeric 6
07	7	Numeric 7
08	8	Numeric 8
09	9	Numeric 9
10	10	Numeric 0
11	11	Decimal point
12	12	00
13	13	NEXT
14	14	PREV
15	15	PROG
16	16	ENTER
17	17	CLS
18	18	ESC
19	19	TARE CAL
20	20	SPAN CAL
21	21	TOTAL DISPLAY
22	22	TOTAL RESET
23	23	SELECT DATA
24	24	SELF CHECK
25	25	ERROR LIST
26	26	SPL FUN
27	27	CLOCK SET
28	28	BELT REV
29	29	INCH
30	30	REMOTE
31	31	OFF
32	32	LOCAL

Table No.1A: Matrix Connection

S.No.	Key number	Matrix connection (Rx ROW NUMBER Cx COLUMN NUMBER)	Key description
01	1	R1,C1 (DI0,DO0)	Numeric 1
02	2	R2,C1 (DI1,DO0)	Numeric 2
03	3	R3,C1 (DI2,DO0)	Numeric 3
04	4	R4,C1 (DI3,DO0)	Numeric 4
05	5	R5,C1 (DI4,DO0)	Numeric 5
06	6	R6,C1 (DI5,DO0)	Numeric 6
07	7	R7,C1 (DI6,DO0)	Numeric 7
08	8	R8,C1 (DI7,DO0)	Numeric 8
09	9	R1,C2 (DI0,DO1)	Numeric 9
10	10	R2,C2 (DI1,DO1)	Numeric 0
11	11	R3,C2 (DI2,DO1)	Decimal point
12	12	R4,C2 (DI3,DO1)	00
13	13	R5,C2 (DI4,DO1)	NEXT
14	14	R6,C2 (DI5,DO1)	PREV
15	15	R7,C2 (DI6,DO1)	PROG
16	16	R8,C2 (DI7,DO1)	ENTER
17	17	R1,C3 (DI0,DO2)	CLS
18	18	R2,C3 (DI1,DO2)	ESC
19	19	R3,C3 (DI2,DO2)	TARE CAL
20	20	R4,C3 (DI3,DO2)	SPAN CAL
21	21	R5,C3 (DI4,DO2)	TOTAL DISPLAY
22	22	R6,C3 (DI5,DO2)	TOTAL RESET
23	23	R7,C3 (DI6,DO2)	SELECT DATA
24	24	R8,C3 (DI7,DO2)	SELF CHECK
25	25	R1,C4 (DI0,DO3)	ERROR LIST
26	26	R2,C4 (DI1,DO3)	SPL FUN
27	27	R3,C4 (DI2,DO3)	CLOCK SET
28	28	R4,C4 (DI3,DO3)	BELT REV
29	29	R5,C4 (DI4,DO3)	INCH
30	30	R6,C4 (DI5,DO3)	REMOTE
31	31	R7,C4 (DI6,DO3)	OFF
32	32	R8,C4 (DI7,DO3)	LOCAL

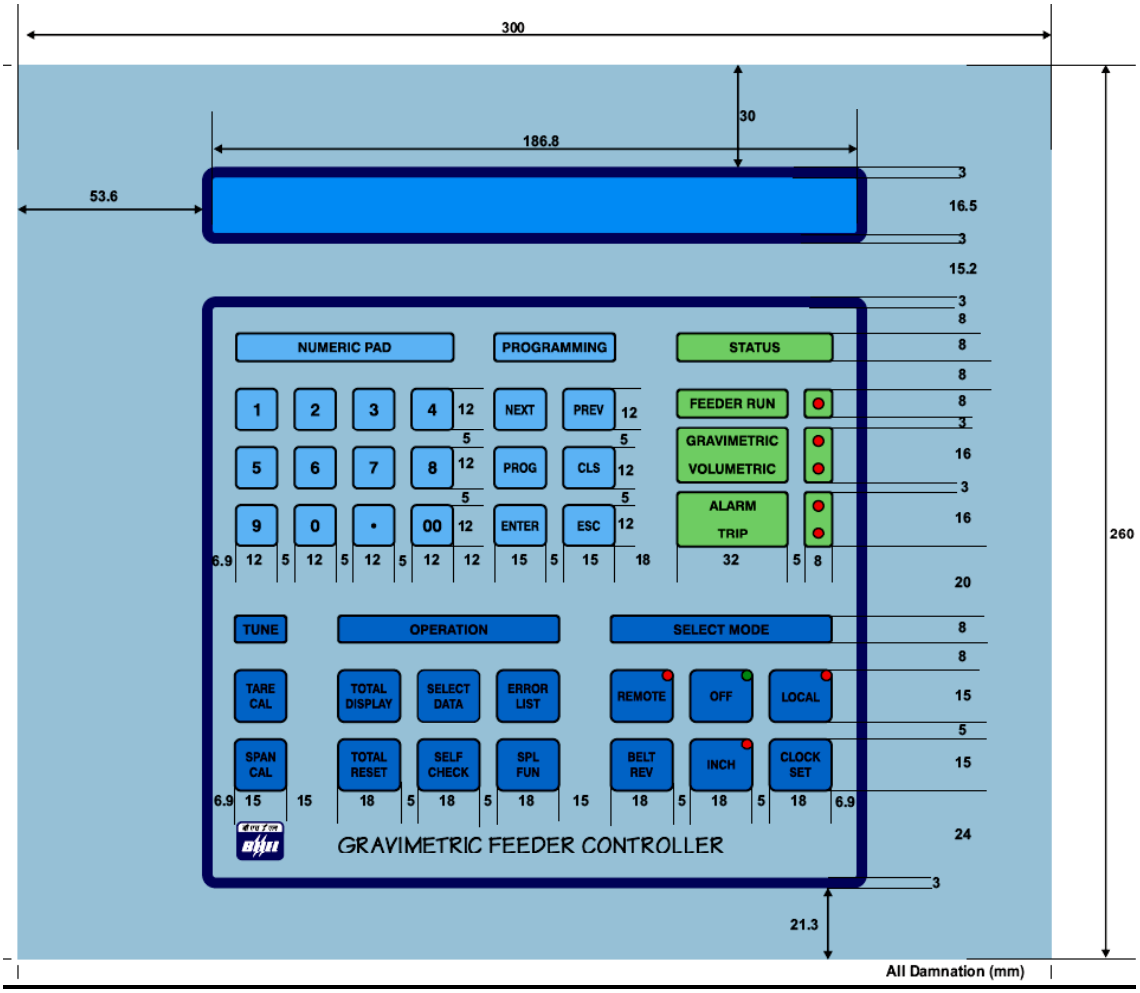
Drawing No.1: Switch Matrix Arrangement And LED Arrangement





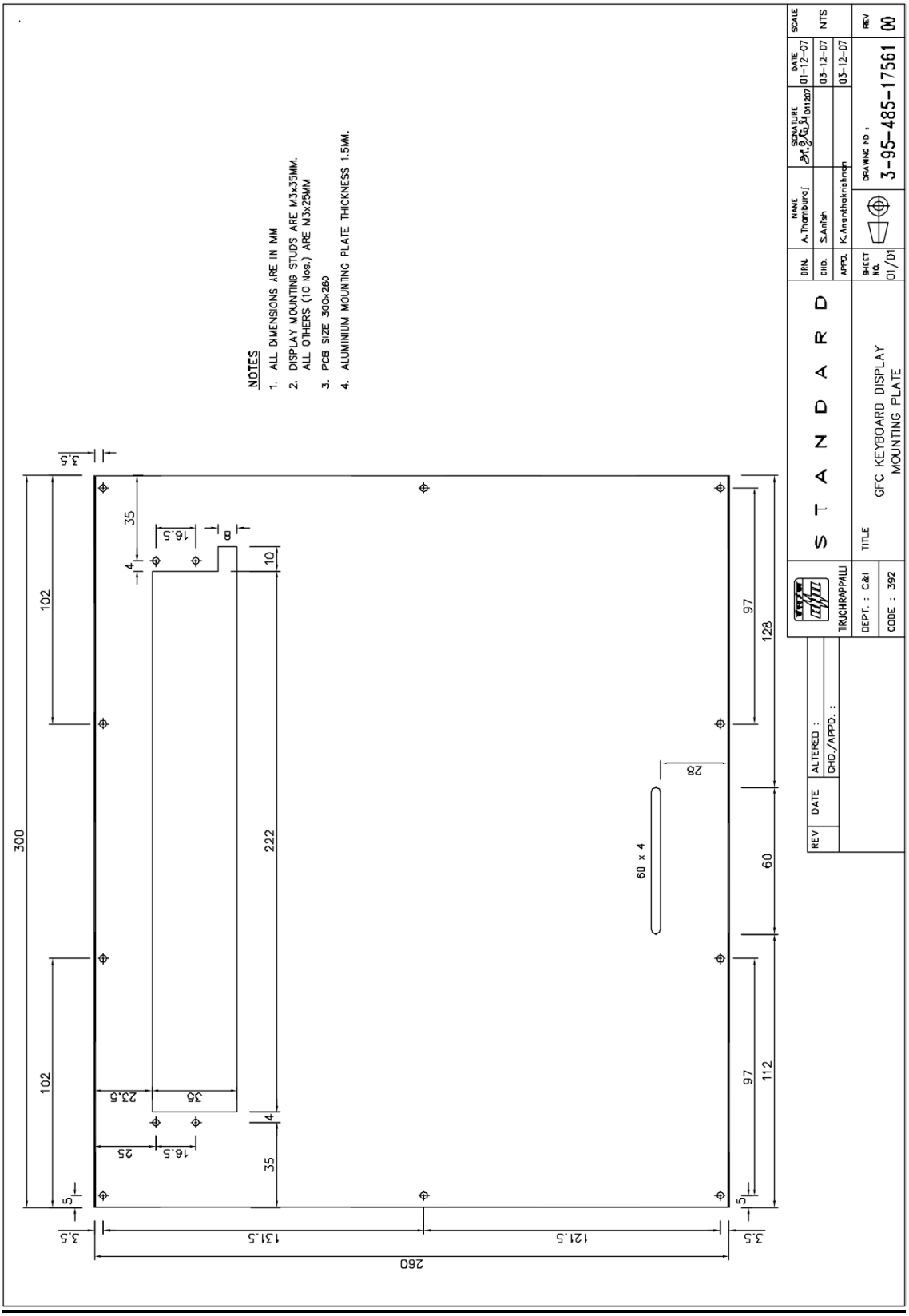
Rev 02

Drawing No. 2 – Key Panel Layout



Rev 01

Drawing No.4: Aluminium Plate for Key-panel mounting



SPECIFICATION NO:TCI:TDC:MPGFC:HMI/Rev 00

SL.NO	DESCRIPTION
1.	VACUUM FLUORESCENT DISPLAY (VFD) MODULE 40-character x 2 line VFD Module Giant Supplier Ltd (U.K) Samsung Part No. 40S203DA4 /Futaba, Part No. M402SD07GR/M402SD64AA

REV.NO.	DATE	DESCRIPTION	PREPARED	REVIEWED	APPROVED
00	01-08-22	Initial release	[SKS]	[KV]	[DK]