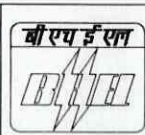


TECHNICAL SPECIFICATION FOR BOUGHT OUT ITEMS

Reference No.	Rev No.	Effective Date
TSAPH:EMBS:ALCS-001	02	27-08-2020
Title	TECHNICAL SPECIFICATION FOR ALCS CONTROLLER AND ITS ACCESSORIES FOR AIR PRE-HEATER	
PROJECT	NTPC / GENERAL	
Prepared by	Sreeraj P Nambiar	
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Issued and Controlled by	Electronic Shop EDC/Embedded Systems BAP/BHEL/Ranipet-632 406	
Document Status	<input type="checkbox"/> Information Copy <input type="checkbox"/> Controlled Copy	<i>It is a control copy only if the mark against the control copy otherwise it will be an uncontrolled copy. Check for current revision.</i>
Record of Revision		
Rev. No.	Effective Date	Remarks
00	10-06-2014	Initial release
01	03-06-2017	TB details modified, Sensor PCB dimensions changed
02	27-08-2020	Separate enclosure for controller removed, Addition of metal conduit.
Issued to :	Control copy No. :	



1. A Technical Specification for Automatic Leakage Control System (ALCS) Controller and its Accessories

The specification covers complete fabrication of PCBs as per given Gerber files, populating PCBs, testing, packing and delivery of ALCS controller and its accessories as per specification, dimensional drawing and BOM enclosed. The test software and test procedure will be provided by BHEL after the purchase order.

2. Scope of Supply

1. ALCS controllers with cable.	--	01 Set.
2. Sensor Electronic PCB with Enclosure Box.	--	01 Set.
3. Interfacing box	--	01 Nos.
4. Shielded Teflon cable (0.5 sq mm)	--	05 Mts.
5. GI flexible metallic conduit	--	05 Mts.
6. Clamps with base plates and screws	--	05 Nos.

3. Technical Specification of Individual Items

3.1 ALCS controller with cable

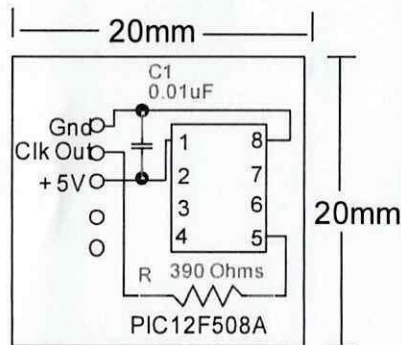
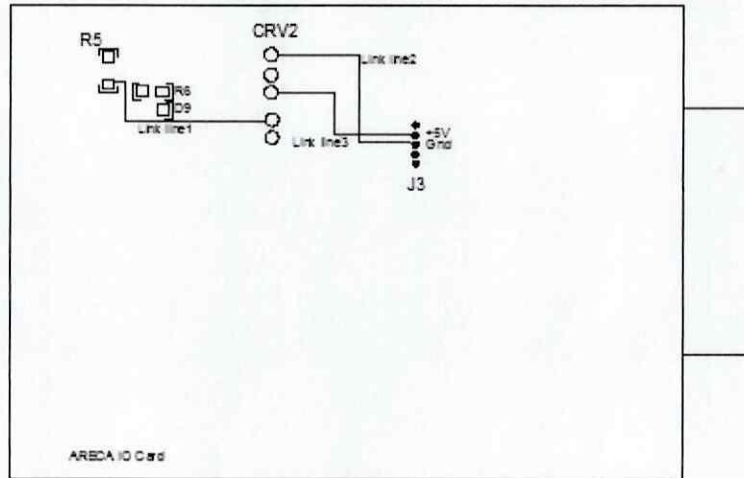
The following are the technical requirements, which are to be strictly adhered to, in the fabrication of the ALCS controller. Any deviation from these requirements will not be accepted by BHEL, unless prior approval from BHEL has been obtained.

Major scope of work covers.

- 1) Gerber file to PCB conversion.
- 2) Component procurement as per BOM.
- 3) Populating the PCBs. (as per standard procedure for SMD and Through Hole components)
- 4) Fabrication of Front fascia, keyboard PCB & Aluminum die cast front Bessel and back cover, L-shaped clamps-2nos. at opposite corners.
- 5) Assembling of controllers and accessories.
- 6) Test program loading and inspection. (no analog preset adjustment or alignment required).
- 7) Packaging.

Note: This controller is same as Areca-ii controller (Controller alone); but front fascia shall be named as ALCS-APH (instead of Areca-ii). Firing card is not part of this specification (BOM for firing card is included in the specification/indent).

- 1) The PCB shall be of 2 layers, the controller has two cards **a)** controller card 140mm x 110mm **b)** I/O card 142mm x 114mm. In addition to this a small piggyback PCB (20mmx20mm) shall be attached to I/O card. Details are given in the following Fig.01.



Timer PiggyBack

Fig 1: A small piggyback Timer PCB to be attached to the I/O card of the Controller

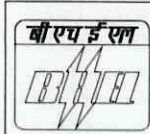
Note: Connecting pins of the Piggyback PCB must be soldered in line with the pins (holes) of CVR2 of Areca IO card. R5 resistor is to be soldered. R5= RESETTABLE FUSE 100mA. Part No.0603L010 C, MC33186, MF-FSMF010X-2

(Make: LittleFuse, Multicomp, Bourns)

2) The PCB shall be of glass epoxy FR4 grade, Class 2, Cu thickness 35microns (minimum), board thickness 1.6 +/- 0.2mm. PTH copper plating in hole should be not less than 25microns with a minimum thickness of 18 microns. Solder masked and the component labels shall be neatly screen printed on the PCB.

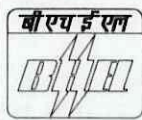
3) Selection of components for the cards shall be strictly as per the bill of material. All components shall be of industrial grade. If the supplier makes any deviation from this BOM the same shall be informed to BHEL. Only when this deviation is accepted by BHEL, the same shall be used. Otherwise the deviation will not be permitted.

4) The passive and active components shall be of SMD type.



- 5) BHEL workmanship standard PR: QA: 555 shall be followed.
- 6) The controller enclosure shall be made of 10mm aluminum bezel and 1.0mm MS Back cover with a fine finishing.
- 7) The front fascia shall be of polyester film but not of polycarbonate or PVC film. It shall have enhanced chemical resistance and dramatically improved flex file.
- 8) NEOPRENE rubber gasket with shore hardness 26 shall be provided in the front part of the casing around the rear part. The front fascia when fixed in the box shall meet IP54 standard.
- 9) Two no. L-Shaped clamps shall be supplied along with each controller. The controller shall have two nos. of tapped drilled holes at the opposite corners on the back cover in such a way that the controller can be fixed in the box using the L-shaped clamps.
- 10) Provision for casing earthing shall be made at the backside of the controller with earth screw and two washers, proper marking of earth symbol shall be made near the earth screw.
- 11) For all combicon connectors mating female part of terminal connector (MVSTB 2.5-5.08) shall be supplied along with the controller and cards.
- 12) The supplier shall get approval for PCB layout, general arrangement of components in the PCB, general arrangement of casing, front fascia sticker, etc. from BHEL, Ranipet before start of manufacture.
- 13) Interfacing Cable

Interfacing cable with 50Pin D-type connector, which will be connected to ALCS controller. The Interface cable shall be of 0.5mts of length, multi strand copper of 16 and 12 core, 0.34 sq. minimum with braided tinned copper screened cable. The insulation of individual conductor shall be extruded PVC meeting the requirement of VDE approval. The outer sheath of the cable shall be extruded. The cable shall be light weight and flexible to bend. The D-type end will be connected to the controller and the other end shall be ferruled and crimped. Refer fig-03.



ALCS controller D-sub 50 pin male connector

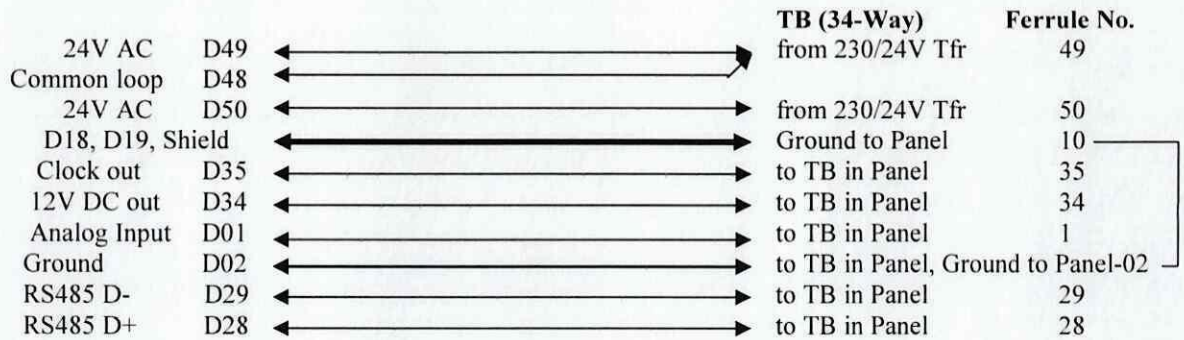


Fig-03- Interfacing cable

3.2 Sensor Electronic PCB with Enclosure Box

Sensor electronics PCB shall be fabricated as per the BOM enclosed along with indent/enquiry. The PCB size and shape is given in the following fig-04. This sensor electronics PCB shall be fixed in a box or casing of size 140mmx100mmx70mm (front side open able & fixed with 4 screws at four corners). The above box shall be made up of 1.5mm thick sheet metal. (Water proof – out door mountable) and shall meet IP65 standards. The box shall have two numbers of 15mm cable glands (Brass metal glands).

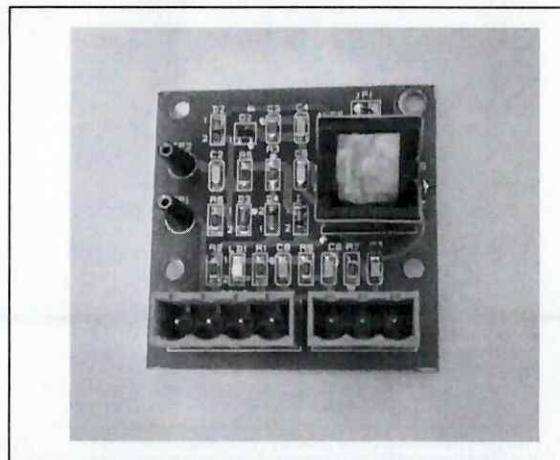


Fig-04- Sensor Electronic PCB, size 50x50mm



3.3 Shielded Teflon Cable

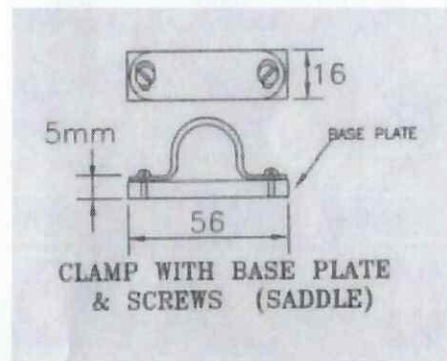
Single core shielded Teflon cable 0.5 sq mm shall be provided.

3.4 Flexible Metallic Galvanized Conduit

- Flexible self locking type metallic galvanized conduit (5Mts, 0.5 inch dia.), for routing the signal cable.
- The minimum galvanizing thickness shall be 10 microns.
- The bending diameter for the flexible conduit shall be 90 mm.

3.5 Clamps with Base Plates and Screws (Saddles)

Suitable galvanized clamps with galvanized base plates of 5 mm thick and 2 sets of galvanized screws for each clamp shall be supplied at the rate of 5 nos. per controller.



3.4 Interfacing Box

The box of size 140mmx100mmx70mm front side open able and fixed with 4 screws at four corners shall be 1.5 mm thick sheet metal (water proof – out door mountable) and shall meet IP65. This box shall have one number of 10mm cable glands (Brass metal glands).



4. Inspection and Testing

4.1 The items shall be tested and inspected by BHEL/BHEL's authorized inspector at supplier's works before dispatch. Only after getting clearance from BHEL, the item shall be dispatched.

4.1.1 Routine Test

The routine tests are to be conducted on all ALCS controllers. During or after the test, if any unit fails that particular unit will be rejected. The followings are the various tests are to be conducted.

(a) Visual check

All the cards shall be checked visually for the make of the components as per the approved Bill of materials. The PCBs shall be checked as per approved Quality procedure and also shall be checked for any soldering track damage. ALCS controller unit shall be checked by inserting the controller in the BHEL approved test jig for cutout dimension.

(b) Functional check

The functional check shall be carried out as per BHEL approved test procedure in each and every stage of type test and routine test.

(c) Soak test

The ALCS controller shall be kept as in normal operation with power on condition for 48 hrs on ambient temperature. The performance shall be satisfactory during and after the test.

(d) Burn In test

The ALCS controller shall be subjected to temperature $+50^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 48Hrs. The rated voltage shall be supplied for 11 hrs followed by $\pm 10\%$ of rated voltage for half an hrs each. This procedure shall be repeated for four such cycles. The performance of the unit during and after the test shall be satisfactory.

The ALCS controller and its accessories shall be inspected and tested based on the following documents.

1. BHEL Purchase Order.
2. BHEL Technical Specification.
3. BHEL Approved bill of materials.
4. BHEL Quality Plan.

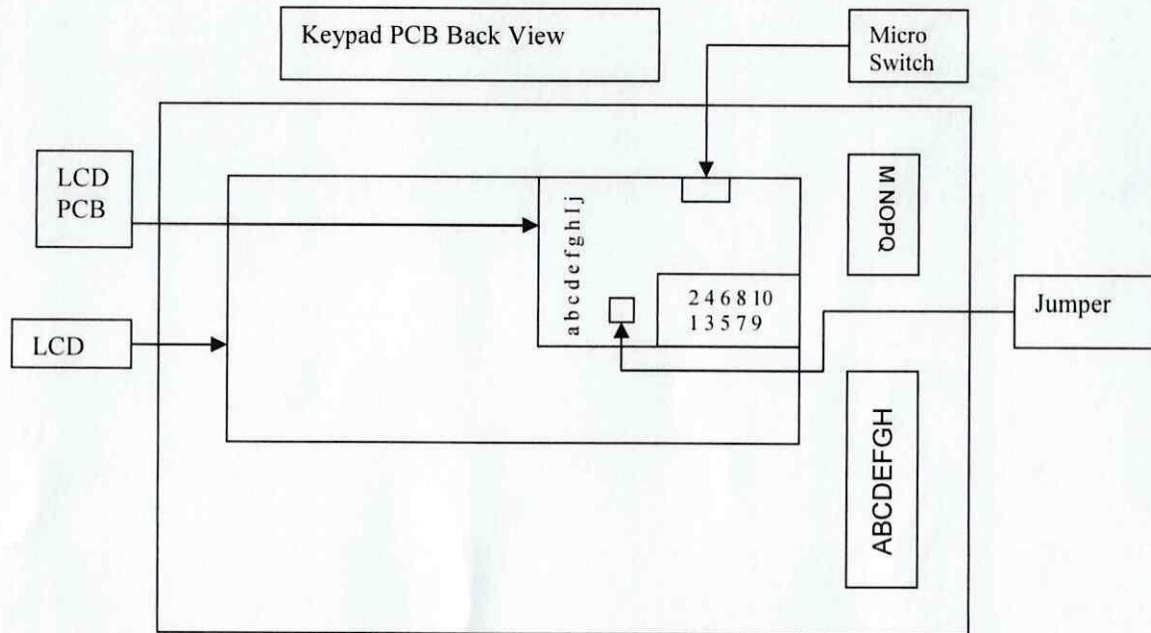


5. Packing

- Each ALCS controller and its accessories shall be packed separately with polythene cover/bubble sheet and thermocol/PUF material sheets and entire set of ALCS controller and its accessories are to be packed in a single corrugated PVC box.
 1. Packing slip shall contain the following information.
 - a) PO no. & date
 - b) Project No.
 - c) Controller Sl. no.
 - d) Item description & quantity
 2. The packing slip shall be pasted on the top cover of each box.
 3. In addition to this material code no. shall be written on both the sides of the PVC box (Font size shall be 35mm).
- Two packets of 10 grams of Silica gel each are to be placed between the cards on both the sides, on the inner surface of each controller to avoid failure due to moisture ingress in the electronic components.
- The silica gel packets shall be provided along with loose card supplies also. For loose card supply orders, one packet of silica gel (10 grams) shall be placed along with each card.
- Shipping marks like "KEEP DRY, FRAGILE, HANDLE WITH CARE and UPRIGHT" shall be provided on the packing.
- In general the packing shall be done in such a way that, the ALCS and its accessories shall not be damaged during transit and storage.

ANNEXURE 1.0

1.1 SEQUENTIAL ASSEMBLY AND TEST PROCEDURE FOR ALCS CONTROLLER



The above diagram shows the back view of the LCD and Keypad panel and its connection spec.

1. Connect one end of the 5pin FRC cable to the "J8" connector (PCB Bottom) of the ALCS controller card. The other end should be connected to the 5-pin connector (MNO PQ) located top right on the front-fascia Keypad PCB. The M,N,O,P,Q pins (see figure above) shall be wired to pin numbers 1,2,3,4,5 of J8 respectively.
2. Connect one end of the 8pin FRC cable to the 10 pin connector on the LCD PCB (abcdefghij as in the above diagram). The other end should be connected to the 8-pin connector (ABCDEFGH) located bottom right on the front-fascia Keypad PCB. The ABCDEFGH pins (see figure above) shall be wired to pin numbers abcdefgh respectively. The 'i' and 'j' pins of the 10 pin connector on the LCD board shall be left open.



3. If MODTRONIX make LCD module is used, remove the link of the jumper on the LCD board and leave the pins open.
4. If MODTRONIX make LCD module is used, the micro switch 1 and 2 shall be kept in OFF position.
5. CON2 from PCB bottom should be connected to the LCD board's 1234... Connector. The connection spec of this connector is given below.

If MODTRONIX make LCD module is used

LCD Board (2x5pin connector)		Controller Board (CON2)
1) 5 th pin	-	+5v (PIN 1)
2) 6 th pin	-	Gnd (PIN 2)
3) 8 th (SDI)	-	SDA (PIN 4)
4) 10 th (Clk)	-	SCL (PIN 6)

If LCD piggy back PCB 001 (as per Annexure 03) is used

LCD Board (4pin connector)		Controller Board (CON2)
1) 4 th pin(+5V)	-	+5v (PIN 1)
2) 3 th pin(GND)	-	Gnd (PIN 2)
3) 2 th pin (SDA)	-	SDA (PIN 4)
4) 1 st pin (SCL)	-	SCL (PIN 6)

6. Connect 24V ac to connector CON11 the controller card.
- On the Controller card at jumper J1, the U1Rx to RxCL and U1Tx to TxCL shall be permanently soldered with jumper wires.
 - Load microcontroller with the program "ControllerConfig.hex" through 'con1' and RUN. LCD will display "configuration completed' message.



ANNEXURE – 02

(This is not applicable if MODTRONIX make LCD is used)

LCD piggy back PCB 001 shall be fabricated as per the bill of materials and gerber files indicated below in sl no. 1 and 2. After fabrication, the hex file indicated in Sl. no. 3 may be used to program the LCD piggy back PCB 001. This can be connected to the LCD, keypad and controller as indicated in Fig.1 (refer Annexure 1.0 for connection details)

1. Bill Of Materials for LCD piggy back PCB 001

LCD piggy back PCB - Bill Of Materials					
SL. NO	CIRCUIT REFERENCE	PACKAGE	Value	MAKE	QUANTITY
1	R1,R2,R3,R4,R5,R6,R7, R8	0805	1K , 0.25w ±5%	WALSIN, YAGEO, VISHAY,AVX	8
2	R9	0805	470E , 0.25w ±5%		1
3	R10	0805	0		1
4	R11,R12,R13,	0805	2K7 , 0.25w ±5%		3
5	R14	0805	4K7 , 0.25w ±5%		1
6	R15,R17				not used
7	R16				not used
8	R18,R19,R20,R21	0805	10K, 0.25W ±5%		4
9	C1	TH	47uF /25v	JACKON,WALSIN, YAGEO, VISHAY,AVX, ELNA	1
10	C2,C3,C4,C5	1206	10nF/63V or 100V		4
11	U1	SOIC -28	dsPIC30F2010-20I/SO	MICROCHIP	1
12	Q1	SOD - 23	BC 548B / BC 847B	PHILIPS(NXP),FAIRCHILD	1
13	LED1	SMD - 1206	LED GREEN	EVERLIGHT	1
14	J1		8 PIN BERG MALE RT	CONNECT WELL, XINYA, TOYO	1
15	J2		16PIN BERG MALE ST		1
16	J3		4PIN BERG MALE RT		1
17	J4		5PIN BERG MALE RT		1
18	LCD		20 x 4 LCD DISPLAY	WINSTAR WH2004A-AFH-ET#	1
19	Piggy PCB		50mm X 50mm Piggy back	PC PROCESS, ANAND ELECTRONICS, MICROPACK, CAPRONICS, SHILTRON	1

2. **Gerber File** - LCD piggy back PCB 001 shall be used for making the piggy back PCB. This Gerber file will be issued after the receipt Purchase order.
3. **The Hex file** - The hex file LCDPiggyBack1v2.hex is to be programmed to the piggy pack card microcontroller. Following is the procedure for programming.
 - a. Insert the programming pins of the programmer into the slots provided for programming (refer Fig. 06)
 - b. Connect to controller card to get power supply to the piggy back card.
 - c. Import the hex file LCDPiggyBack1v2.hex in MPLAB IDE
 - d. Select the programmer in MPLAB IDE and program the piggyback card
 - e. After programming, ensure that the LCD module displays the following

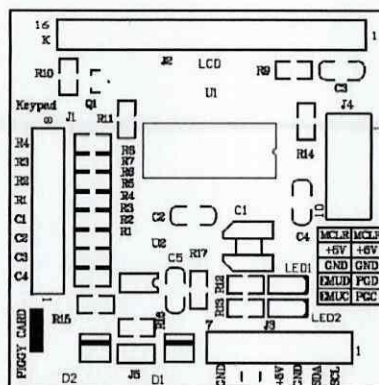
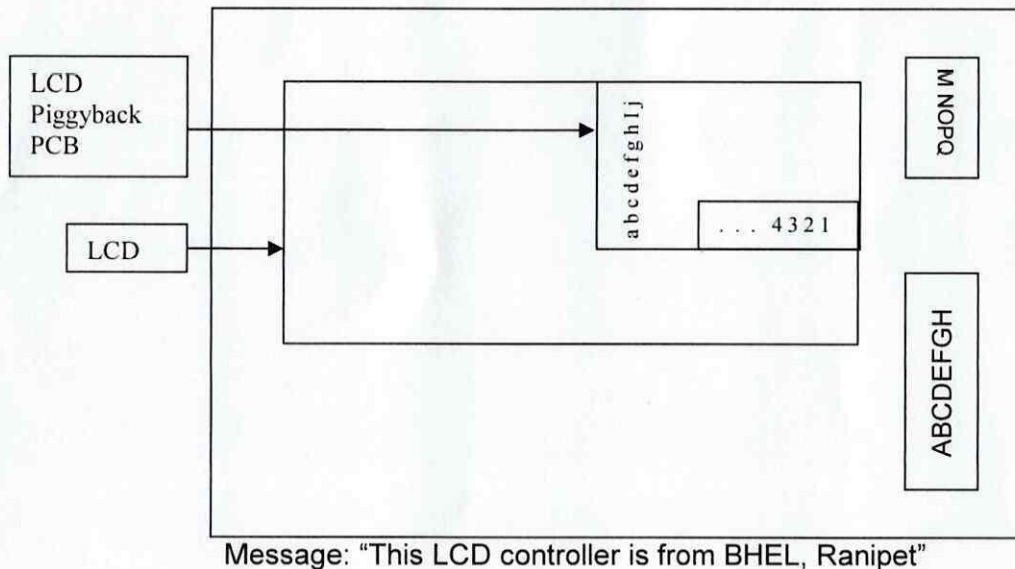


Fig 06- Piggy PCB top silk



ALCS Controller Test

- The points CL- & center pin of jumper J1 and CL+ & Center pin of jumper J2 shall be permanently soldered with link wires on the I/O card.
- Connect both controller card and IO card matching the berg pins.
- Keypad and LCD should be connected with the controller card with its appropriate connectors. Then connect the Areca self test dongle unit in 50 pin D-Sub connector.
- Provide 24VAC at the 2pin connector of the dongle unit.
- Ensure the following after power on the cards:
 - In IO card LD 19, 20 & 21 should glow for +12V,-12V & +5v indication respectively.
 - LD18 (Amber) and LD6 (Green) will glow.
- Program the controller from IO card through 'J3' with the given "ARECA TEST DONGLE 3v0.hex" file.
- All LEDs on the front-fascia will be scrolling continuously if there is no error. If any error will be indicated then Alarm LED will be glowing continuously and others will be scrolling.
- If there is no I/O error then a message "No hardware errors" will be displayed, otherwise, the errors will be listed with the relevant components' legend name.
- In this IO card checking the keypad keys can also be checked.