Control of System Software as per clause 5.18 of API16D edition 3rd

Rev	Reason of Change	Date	Prepared by	Reviewed by	Approved by	Status
0	Initial release	15-02-2024	PK	USR	JG	Released

Control of System Software as per clause 5.18 of API 16D edition 3rd.

1. Purpose

1.1. The scope of this procedure for BOP control system software design verification, installation and validation procedure. It also includes software FMEA and its maintenance.

2. Reference documents

2.1. API 16D

3. General requirement as per clause 5.18.1 of API16D

3.1. The control system software requirement per customer should be fulfilled. The proof of fulfilment should be verified , documented and provided to customer. The Proof of fulfilment is tobe covered through **Factory Acceptance Test (FAT) procedure for indivisual control unit (R&D-CTP-0002).**

3.2. The referance standards and process involved in the design and development of the system software is tobe followed properly.

3.3. The processes involved in Design and Development beside upgrdation of software is tobe documented with traciblity records and revision no. **(eg**: The PLC input and Output addressing to be preseved with identification no.)

3.4. The software is passoward protected to prevent its use by the person do not have in proper knowledge of design and deveoploment of software.

3.5. **Software used**- 10.0 PAC Machine Edition Professional Development Suite
programming language - Ladder Diagram OR LD
Standard used- IEC 61131-3
programmable logic controller (PLC) used – EMERSON

4. Classification of Software Life Cycle Process as per clause 5.18.2 of API 16D

Software life cycle is process by which software is developed , deployed and sucessfully installed on the control unit.

The software life cycle process shall include the following:

4.1. Software functional specification

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4.2. Software Design and Development

4.3. Software Verification and Validation

4.4. Software Production and Maintenance

5. Software functional Specification per clause 5.18.3 of API16D

5.1. All the functional specfication is documented per clause **5.18.3.1 of API16D** in **Annexure 'A'**.

5.2. All the additional functional specification is documented per clause **5.18.3.2 of API16D** in **Annexure 'A'**

5.3. Technical requirment of system capabilities represent in checklist and documented per clause **5.18.3.3 of API 16D** in **Annexure 'A'**

5.4. Software functional specification review format documented per clause **5.18.3.4 of API16D** in **Annexure 'B'**

6. Software Design and Development as per clause 5.18.4 of API 16D

6.1 Software design review should be conducted and tested at different stages as per clause **5.18.4.1 of API 16D**. All panel should be tested individualy at preliminary , critical and final design stages and documented in **Annexure 'B'**

6.2 The system design architecture drawing includes system topology,logic flow diagram as per clause **5.18.4.2of API16D** and documented in **Annexure 'C'**

6.3 Failure modes effect analysis (FMEA) per clause **5.18.4.3 of API16D** is tobe carried out and documented in **Annexure 'G'.**

6.4 The design and development of software code should follwed per IEC standard.

6.5 The software code includes the design and devoplement of programming software that it could be understood and implemented by other relevant software engineer. as per clause **5.18.4.5 of API16D**

6.6 Softcopy of installation and **devoplement tools guide** should be documented as per clause **5.18.4.6 of API16D** (manufecturer, software plateform and version) .

6.7 Software itself enables developer to provide the possible solution if some error occured. Generally,this is possible by using PLC software inbuilt.

7. Software Validation and Verification as per clause 5.18.5 of API 16D

7.1 Software verification and validation for BOP control system enable user to provide local,

system and global effect per **Annexure 'G'**

7.2 **PLC** Software enable and validate all the operational logic , instructions and communication parameter

7.3 The Individual software component testing is tobe documened in **Annexure'B'**

7.4 Assembled panel testing performance is tobe documened in **Annexure'B'**

7.5 Every line of code and correspounding logic path having statement true/false is tobe executed at least once. This facility is availble in plc software itself.

7.6 The Software integration level test is tobe done to test the complete integrated Modules beside testing individually before integrating the components. Once all the module are tested,software integration testing is done by integrating all the modules and the system as a whole is tested. and the result is tobe documented in **Annexure'B'**

7.7 The testing shall be performed with BOP control unit per **Factory Acceptance Test procedure (FAT).**

7.8 In case of failure of the communication between the panels provision of communication fail alarm is to be incorporated through software.

7.9 Every line of code and logic path shall be tested as part of white box testing as per **Annexure 'E'**

7.10 Single Unit funcitionality which provides input v/s output shall bee treated as black box testing as per **Annexure 'B', Annexure 'F' & Annexure 'A'**

8. Software Production and Maintenance as per clause **5.18.6 of API 16D**

8.1. The modification to existing software shall be reviewed and documented in softcopy (retain old program and modify program)

8.2. The PLC software is developed ,deployed and installed under shoftware development life cycle (SDLC) with traciablity records.

8.3. The Updated software if amended is tobe reviewed and documented in softcopy.

8.4. The software shallbe recorded with its current revision having all the details i.e.date, time, reason, unique identification and name of person conducting change. Software Back-up is tobe stored in safe location seperately. in **Annexure'H'**

8.5. Risk assesment is not to be carried out for software scurity being no external excess and internet accessiablity to software.

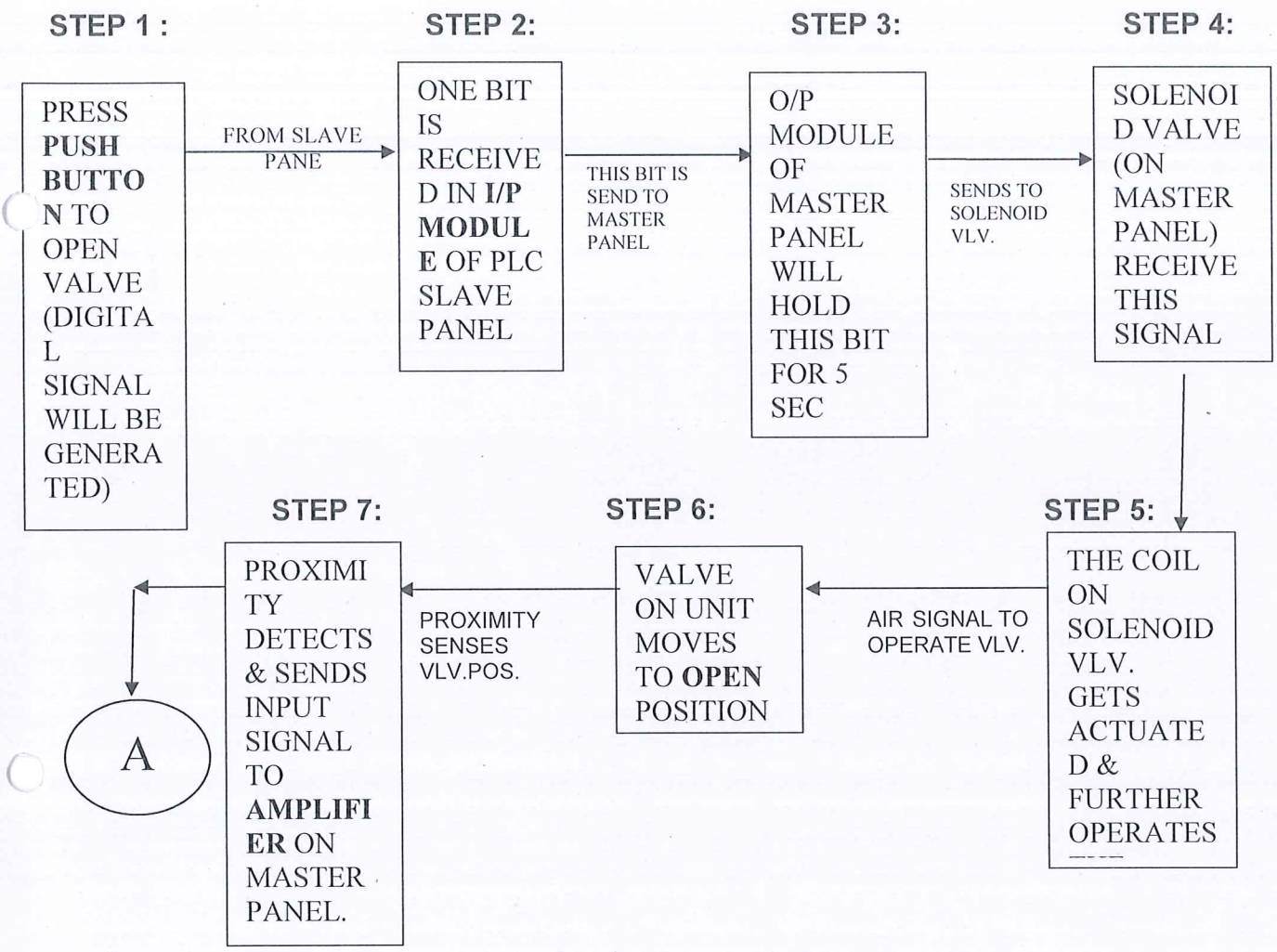
8.6. The latest version of manufacturer supplied software platform is to be used to create PLC Programme for control unit.Date of incorporation of latest software platform is tobe recorded.

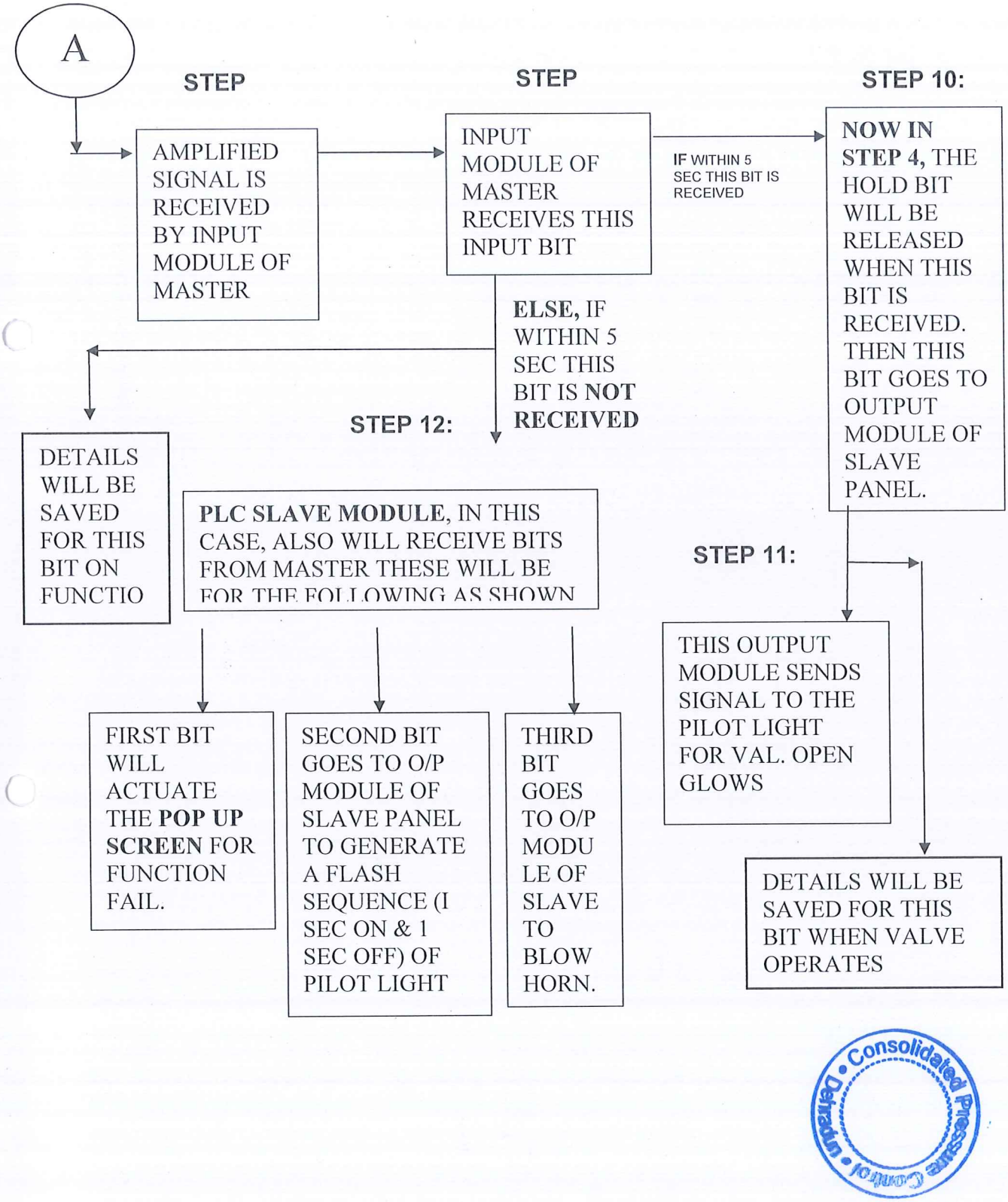
Annexure 'C'

SOFTWARE FUNCTION PROCEDURE FOR PLC SLAVE PANEL

OBJECTIVE: TO CREATE A BLOCK DIAGRAM WHICH WILL SHOW HOW A VALVE CAN BE OPERATED FOR OPEN & CLOSE FUNCTIONS

BASIC LAYOUT: (A) FOR OPEN FUNCTION





NOW THESE THREE BITS WILL HAVE TO RESET BY ACKNOWLEDGE (ACK.) BUTTON ON THE SLAVE MODULE.

STEP 13:

ACK. CAN BE DONE EITHER FROM TOUCH SCREEN OR RESET PUSH BUTTON ON PANEL.

STEP 14:

WHEN ACK. BUTTON IS PRESSED, THIS BIT GOES TO INPUT OF SLAVE PANEL.

STEP 15:

THIS BIT WILL CORRESPONDINGLY MOVE TO THE MASTER PANEL.

STEP 16:

THIS RESET WILL CHANGE THE STATE OF BITS (HIGH TO LOW) IN THE MASTER

STEP 17:

NOW THE SCREEN POP UP WILL BE RESET, FLASH WILL STOP & HORN WILL BE SILENCED IN THE SLAVE PANEL.

(THIS WILL BE BECAUSE THERE WILL BE NO SIGNAL FROM MASTER PANEL FURTHER)

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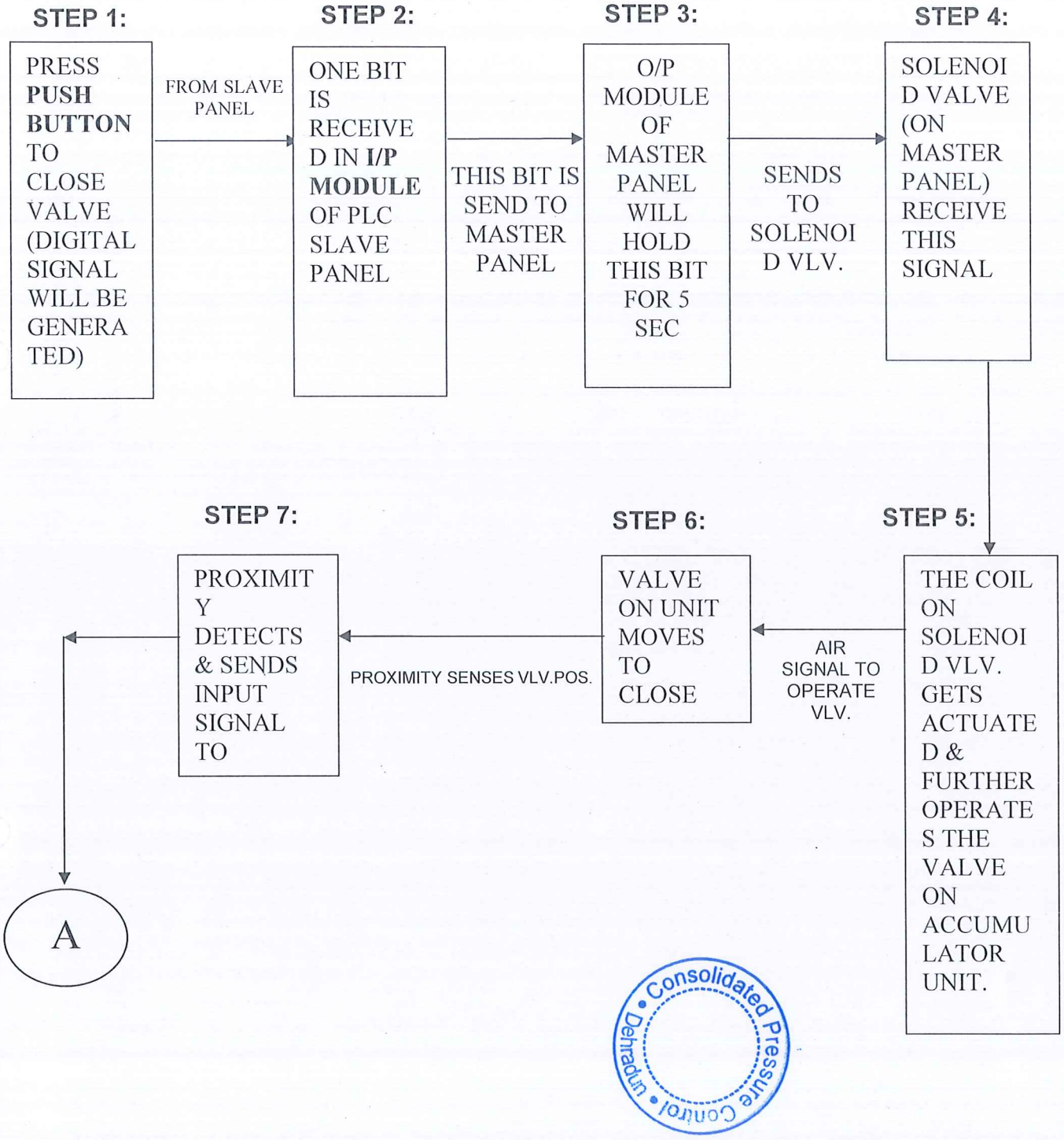
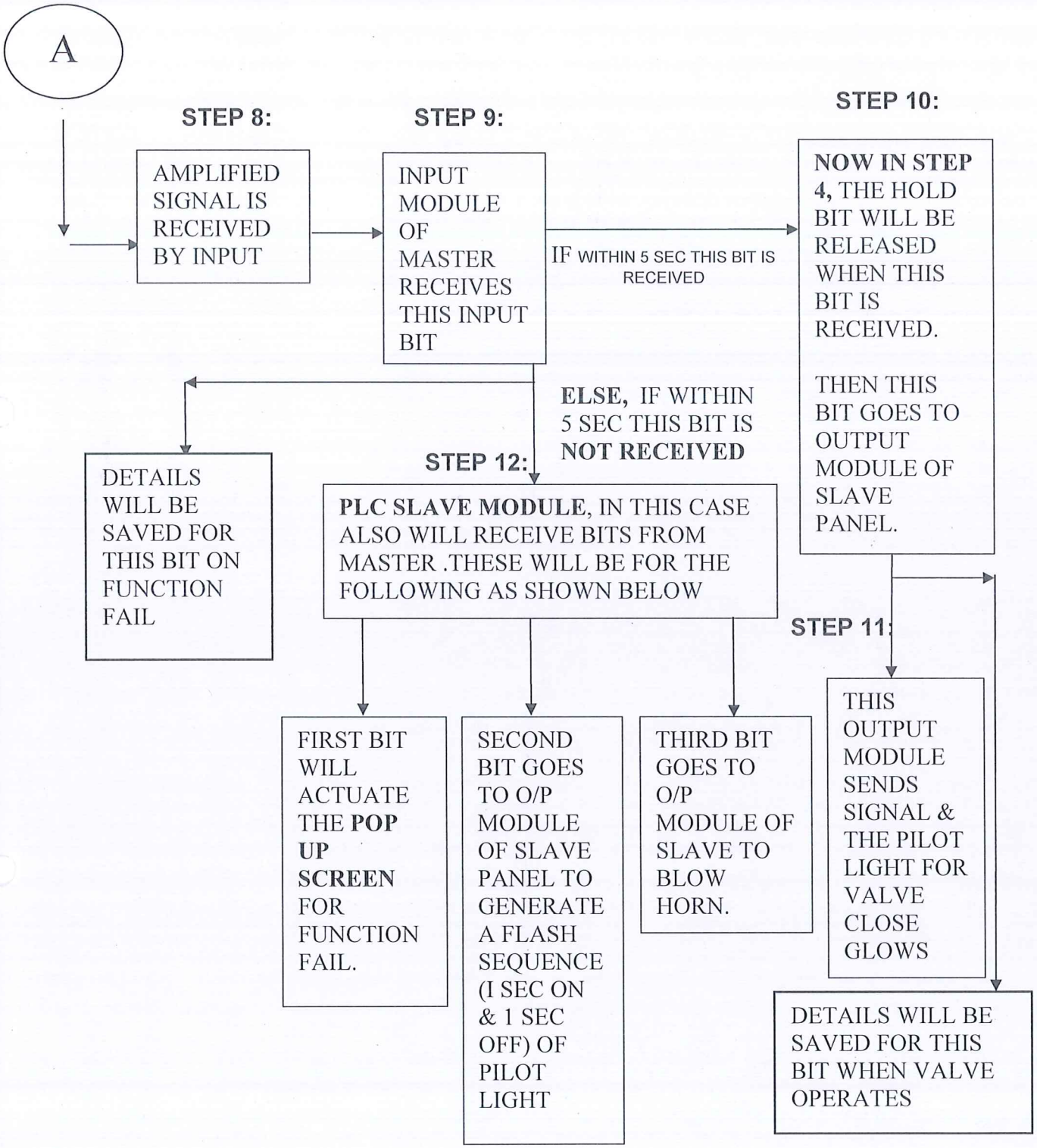
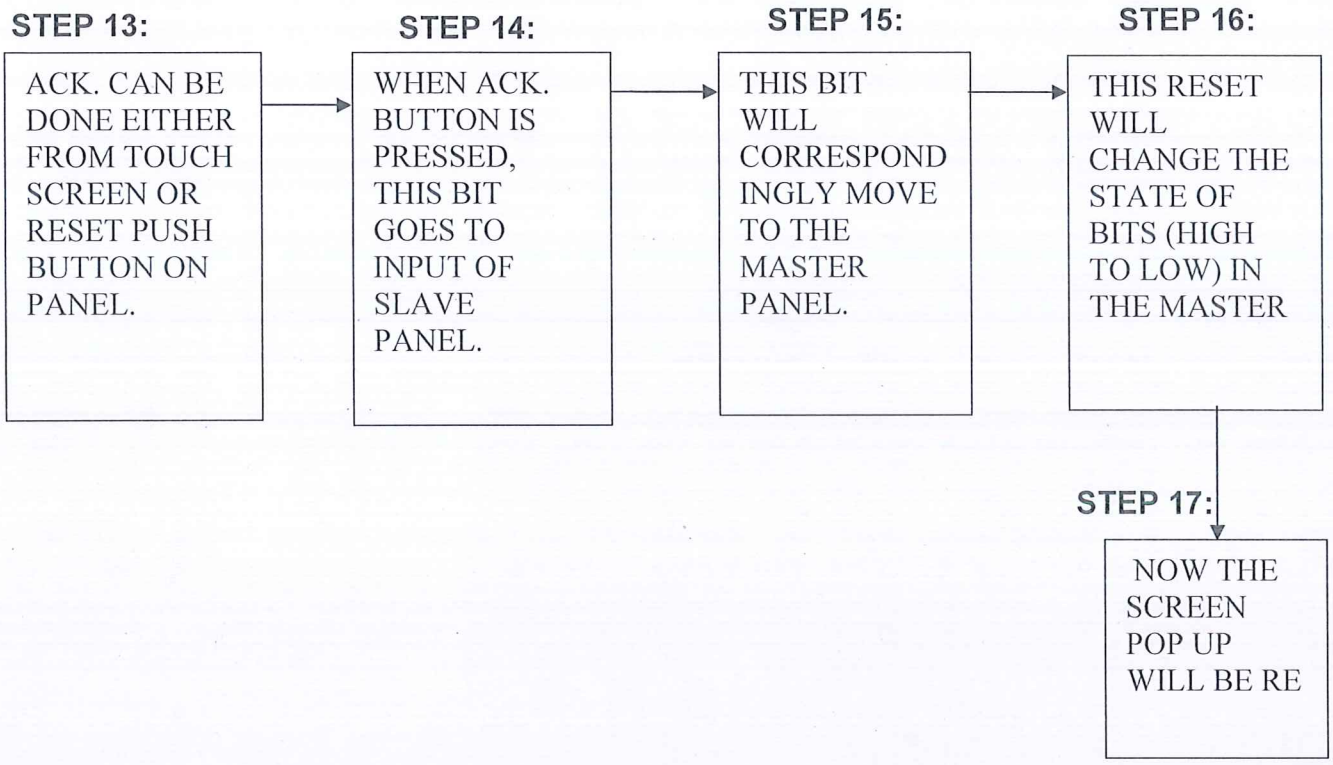
BASIC LAYOUT: (B) FOR CLOSE FUNCTION





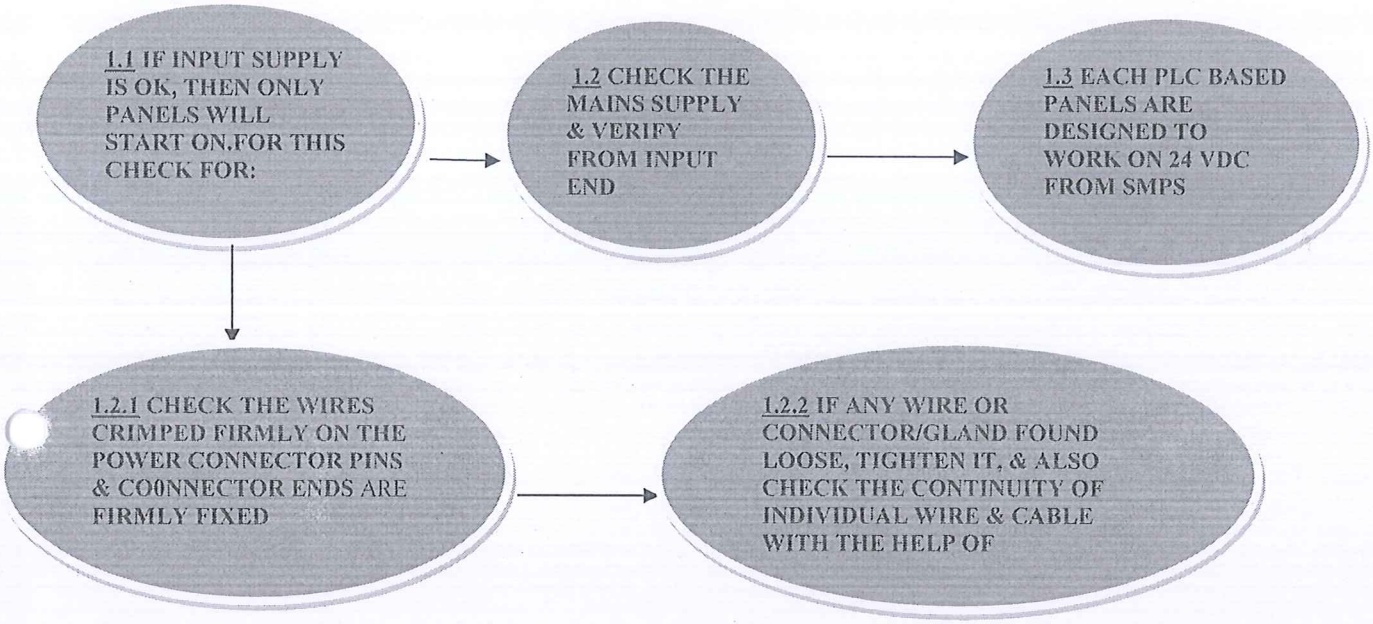
NOW THESE THREE BITS WILL HAVE TO RESET BY ACKNOWLEDGE (ACK.) BUTTON ON THE SLAVE MODULE.



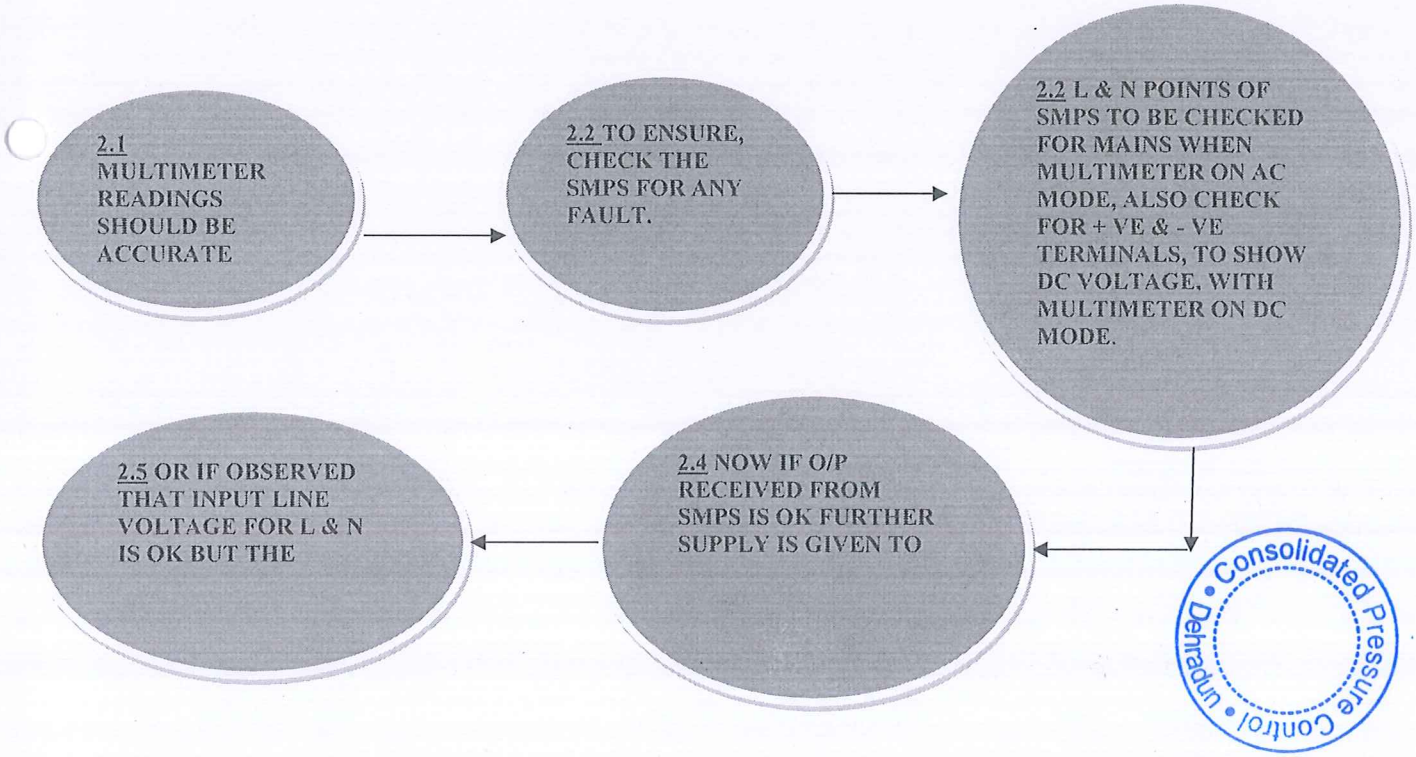
(THIS WILL BE BECAUSE THERE WILL BE NO SIGNAL FROM MASTER PANEL FURTHER)

TROUBLESHOOTING GUIDE FOR SMART CONTROL PLC PANEL

FAULT - 1: ON TURNING ON THE PANEL, NOTHING COMES UP



FAULT - 2: AC –DC CONVERTER (SMPS) IS SUSPECTED TO RECEIVE MAINS SUPPLY & CONVERT TO DC



FAULT - 3: PROBLEMS OBSERVED ON PLC MODULES

- POWER SUPPLY
- CPU MODULE
- GENIUS BUS CONTROLLER
- INPUT MODULE/s
- OUTPUT MODULE/s
- ANALOG I/O

3.1 DURING NORMAL OPERATION, PWR SUPPLY WHEN GIVEN 24VDC SHOULD SHOW LED'S GREEN FOR PWR, OK & RUN

→

3.2 NOW IF PWR LED IS NOT GLOWING GREEN THEN IT IMPLIES THAT THE PWR SUPPLY HAS ENCOUNTERED SOME HARDWARE PROBLEM & NEEDS TO BE REPLACED.

→

3.3 IF PWR LED GLOWS BUT OK LED IS NOT GLOWING GREEN, IT IMPLIES CPU MODULE NOT RECEIVING PWR FROM PWR SUPPLY

↓

3.5 IN SUCH CASE, IT IS ADVISABLE TO REPLACE CPU MODULE.

←

3.6 ALSO SOMETIMES IT IS OBSERVED THAT PWR, & OK, LED ARE ON BUT RUN LED IS NOT COMING UP

←

3.7 IN SUCH A CONDITION IT IS COSIDERED THAT THE PLC IS NOT IN RUN MODE & HAS TO

TO BRING THE PLC INTO RUN MODE FOLLOW THE STEPS BELOW:

STEP - 1 →

3.7.1 WHILE THE PANEL IS ON, MOVE THE KEY SWITCH OVER THE PLC FROM STOP TO RUN POS. 2-3 TIMES SIMULTANEOUSLY.IN SERIES 90-30 PLC THIS KEY IS VERY WELL SEEN .

STEP - 2 →

3.7.2 STOP THE PLC PANEL.ENSURE THERE IS NO POWER INSIDE THE ENCLOSURE, NOW PLUG OUT THE INTERNAL BATTERY (3V), FROM THE PWR SUPPLY MODULE.AGAIN REPLACE THE BATTERY IN THE SAME POSITION AFTER 4-5 SEC.

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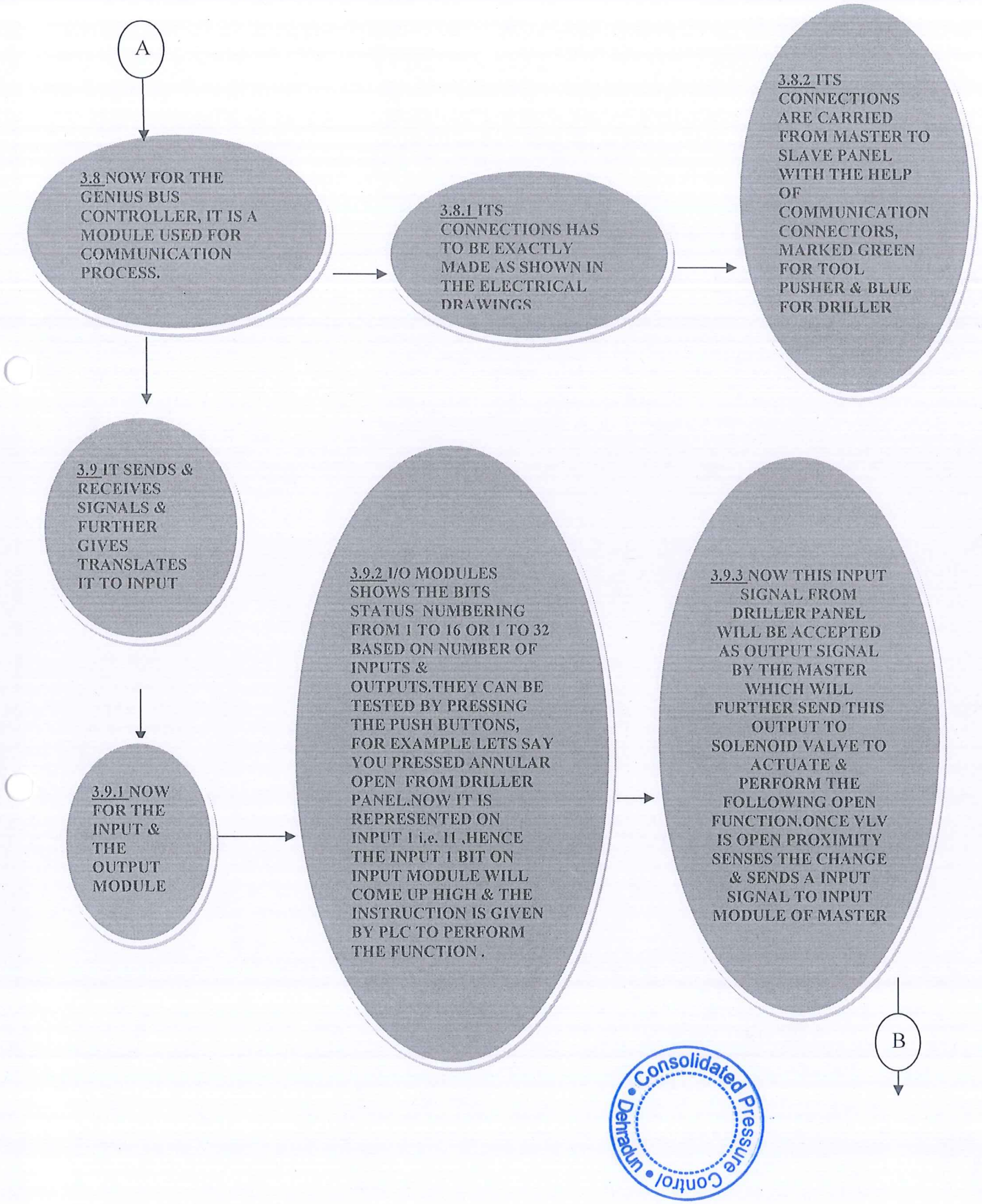
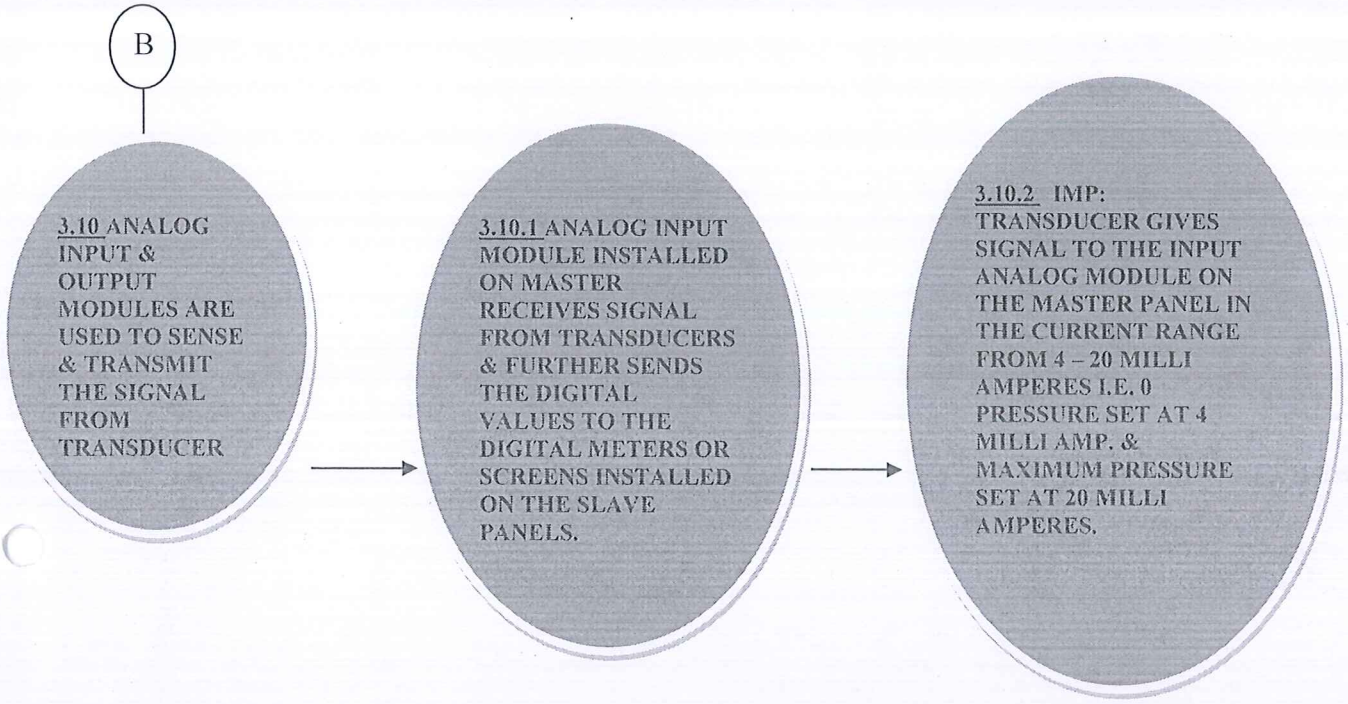




FAULT- 5: NO COMMUNICATION BETWEEN MASTER PANEL & SLAVE PANELS.

IF FAULT IS SUCH THAT THERE IS NO COMMUNICATION AMONG THE PANELS .MAKE THE FOLLOWING CHECKS ONE BY ONE.

4.5.1 STEP 1

> FIRSTLY VERIFY THAT ALL THE PANELS ARE SWITCHED ON

>NOW ENSURE THAT ALL PANELS ARE IN RUN MODE.

>TO CHECK WHETHER PANELS HAVE PROGRAM STORED IN EACH OF THEM, PRESS LAMP TEST BUTTON (LTB).

>NOW IF WORKING ON PANELS WITH TOUCH SCREEN, ON PRESSING LTB, ALL LIGHTS WILL COME UP, IF PROGRAM IS STORED IN CPU MODULE.

>IF WORKING WITH DIGITAL GAUGS, ON PRESSING LTB, LIGHTS WILL COME UP FOR MOTOR RUN & ALARM INDICATION.

> NOW IT ABOVE CONDITION IS NOT SATISFIED THEN PROGRAM NEEDS TO BE STORED INTO THE PLC CPU MODULE.
SEE STEPS 3.7.1 -3.7.3

>DURING THIS PROCESS ALSO MAKE SURE THAT I/P BIT IS GENERATED EVERYTIME LAMP TEST IS PRESSED.ELSE CHECK WIRE CONNECTION FOR LAMP TEST.

4.5.2 STEP 2

> CHECK THE PLUG & SOCKET OF COMM. CONNECTOR TO BE LOOPED PROPERLY.IF FOUND LOOSE TIGHTEN THEM.

>CABLE WIRES MUST BE FIRMLY CRIMMPED INTO PINS OF SOCKET, IF FOUND LOOSE AGAIN DISMANTLE IT AND CRIMP.

>COMMUNICATION CABLE TO BE CHECKED FOR ANY BREAKAGES OR TAMPERED IN BETWEEN THEIR LENGTHS.

>IF CABLE FOUND NOT FIT FOR USE, REPLACE THE COMPLETE CABLE.

>CHECK THE WIRING CONNECTIONS OF GENIUS BUS CONTROLLER

>IF USING SERIES 90-30 PLC SEE THAT SER 1, SER 2 FROM MASTER IS CONNECTED IN SERIES WITH SLAVES & SHLD IN & SHLD OUT ARE LOOPED AS PER DRAWING.

>IF WORKING WITH VERSA MAX PLC MODULES TWO POSSIBILITIES EXIST.
IF WORKING ON WIRED ETEHRNET COMM. FOLLOW FIRST FOUR STEPS AS ABOVE.

IF WORKING WITH WIRELESS MODULE ENSURE FOR ACCURATE CONNECTIONS B/W PLC TO SWITCH & SWITCH TO ANTENNA, *SEE OPERATIONAL MANUALS FOR DARWINGS.*

FAULT- 6: NO READINGS IS OBSERVED ON DIGITAL GAUGES

6.1 DIGITAL METERS (DM) ARE USED TO SHOW PRESSURE READINGS OF ACCUMULATOR, MANIFOLD, ANNULAR & RIG AIR PRESSURE.POSSIBILTY EXIST THAT THESE DIGITAL METERS (DM) WOULD NOT SHOW READINGS OR WOULD NOT WORK AS DESIRED.FOLLOW THESE TROUBLE SHOOTING STEPS

6.1.1

IF DM IS NOT SHOWING ANY READINGS FIRSTLY CHECK THE 24 VDC SUPPLY ON IT.

NOW CHECK THE CONNECTIONS BETWEEN THE ANALOG OUTPUT MODULE & THE DM WITH THE HELP OF MULTIMETER MAKE SURE YOU SWITCH OFF THE PANEL EVERYTIME, BEFORE CHECKING THE CONTINUITY.CONNECTIONS HAS TO BE ACCORDING TO ELECTRICAL DRAWINGS ATTACHED WITH THE MANUALS.

6.1.2

UPTILL NOW IF THINGS ARE OK, THEN CHECK THE INPUT SIGNAL RECEIVED FROM MASTER PANEL.
TRANSDUCER PROVIDES THE OUTPUT SIGNAL IN THE RANGE FROM 4 – 20milli Amp.
TRANSDUCER SIGNAL IS FED TO ANALOG INPUT MODULE WHICH READS THE PRESSEURE VALUES & SENDS IT TO ANALOG OUTPUT MODULE FOR FURTHE DISPLAY TO DM.
CROSS CHECK ALL THE CONNECTIONS WITH ELECTRICAL DRAWINGS & TRANSDUCERS FOR ANY LEAKAGES.

6.1.3

AFTER FOLLOWING THE FIRST TWO STEPS, IF ALL THE CONNECTIONS & SETTINGS ARE FOUND OK & STILL NO READING IS DISPLAYED ON DM WHEN THERE IS READINGS ON ANALOG GAUGEA ON UNIT, PROGRAM THE GAUGE AS PER THE PROGRAMMING STEPS ATTACHED ABOVE.

6.1.4

ANOTHER FAULT THAT A DM CAN HAVE IS, GAUGES SHOWS CORRECT READINGS BUT WHEN PRESSURE DROPS, NO CUTOFF RELAY IS ACTIVATED FOR ALARM SIGNAL TO BLOW & INDICATE LOW PRESSURE.
IN SUCH CASE FIRSTLY CHECK THE CONNECTIONS FOR ALARM ON DM AS PER DRAWINGS.
IF CONNECTIONS ARE FOUND OK AND STILL ALARM NOT COMING, THEN MAKE THIS VISUAL CHECK, OBSERVE SETPRESSURE INDICATOR (SP) OUT OF SP1/SP2/SP3/SP4 HIGHLIGHTED RED ON THE RIGHT PORTION OF THE DM .IT SHOWS THAT THE PARTICULAR RELAY IS ACTIVATED FOR THE ALARM TO ACTIVATE.IF THIS SP INDICATION IS NOT VISIBLE,

License -

Order Number: EM00439594
Purchase Order #: 824817U

Software	Qty	Description	Serial Number	Legacy Serial Number	Contract Level	Contract End	Activation Code	Action
PAC Machine Edition	1	Machine Edition v10.0 Professional Development Suite 700 Points	7-43959401-003-001	7-43915201-003-001,7-43915201-003-002	None		6be0106c-db65-446a-ae0e-b2a4d4d12a9e	Updated
PAC Machine Edition	1	Machine Edition v10.0 Professional Development Suite 700 Points	7-43959401-003-002	7-43915201-003-001,7-43915201-003-002	None		a4e0ba2a-28bc-4ab0-bdd4-cd167320a73b	Updated

Objectives

Programming Languages are LD, SFC, FBD, CFC and ST.

Ladder Diagram remains popular and easier because of its graphical nature so we used LD (Ladder Diagram).

As with lawn power tools, it is most efficient to use the best programming language for the application, to avoid the complexity of driving the square application peg into the round tool hole. With IEC 61131-3 programming languages, PLC programming and maintenance are enhanced when the strengths of all the languages are used.

Programming languages: LD, SFC, FBD, CFC and ST

the strengths and best applications Ladder Diagram (LD) and Sequential Function Chart (SFC).

"Which IEC 61131-3 Programming Language is best? Part 2" will discuss Function Block Diagram (FBD), Continuous Function Chart (CFC), Structured Text (ST), and how they can be mixed and matched for optimal results.

What is Ladder diagram (LD) programming?

Ladder diagram programing or LD, traces its history back some 100 years to relay ladder logic (RLL), which was created to describe systems of electrical components such as relays, timers and motors. In the early days of automation, when PLCs were replacing relays and timers, it made perfect sense to create a programming language familiar to the user base and similar to the tool it was replacing. Unfortunately, as controllers became more capable and evolved past relays and timers, the original LD language was pressed into service. It was never intended for and was poorly suited.

This situation was exacerbated by the slow pace at which PLC vendors provided new languages better suited to PLC and programmable automation controllers (PAC) applications. This was particularly true with controllers originating in North America, which explains the global differences in the enduring popularity of LD.

Strengths of LD programming

The strength of LD and the key to its enduring popularity is its graphical nature. Of all the generalizations one can say about engineers, it is safe to say engineers tend to be graphically oriented. (Who among us can effectively communicate without paper and pencil, or a white board?) Early on, most LD programming alternatives were text-based languages that did not resonate with engineers' graphical nature. This led to further reluctance to move on from LD. Fortunately, that situation is changing.

LD remains a great language for which it was originally intended – complex Boolean logic. Staying within this realm, LD logic is simple to design and simple to debug. Figure 3 illustrates this point by showing the same Boolean logic in several IEC 61131-3 languages. Say we are expecting "Inspect" to be TRUE. How easy is it to determine why the result is not as expected? In LD, the answer is quickly determined by observing where the path of solid blue contacts is interrupted.

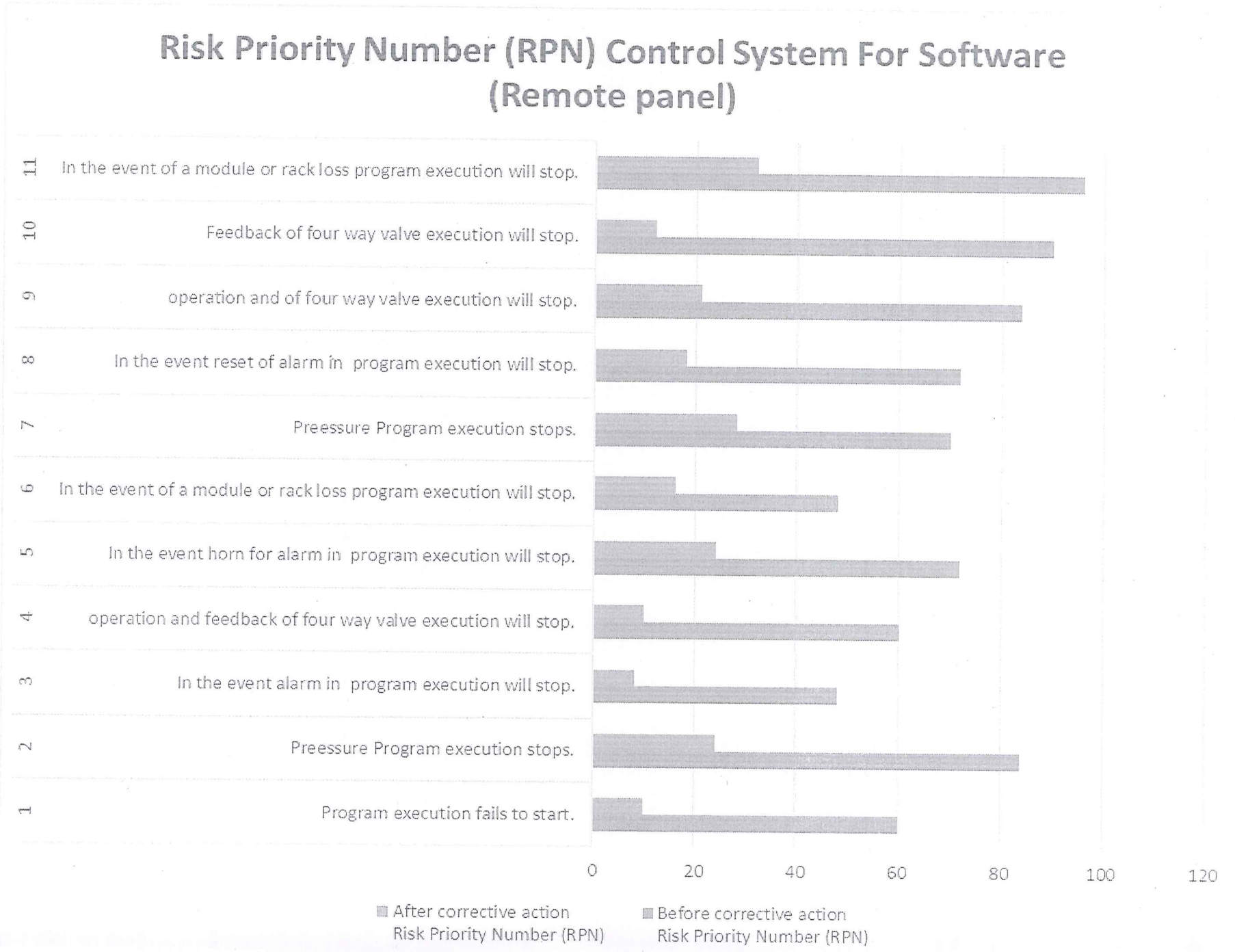
Use the right language for control system programming

To communicate effectively in the English language, it's important to have the right vocabulary and know how to use that vocabulary effectively. To create effective industrial controls programs, it is important to have the right languages and know how to use those languages effectively. IEC 61131-3 provides the languages, and this article has provided guidance on effective use of LD

SOFTWARE (REMOTE PANEL)

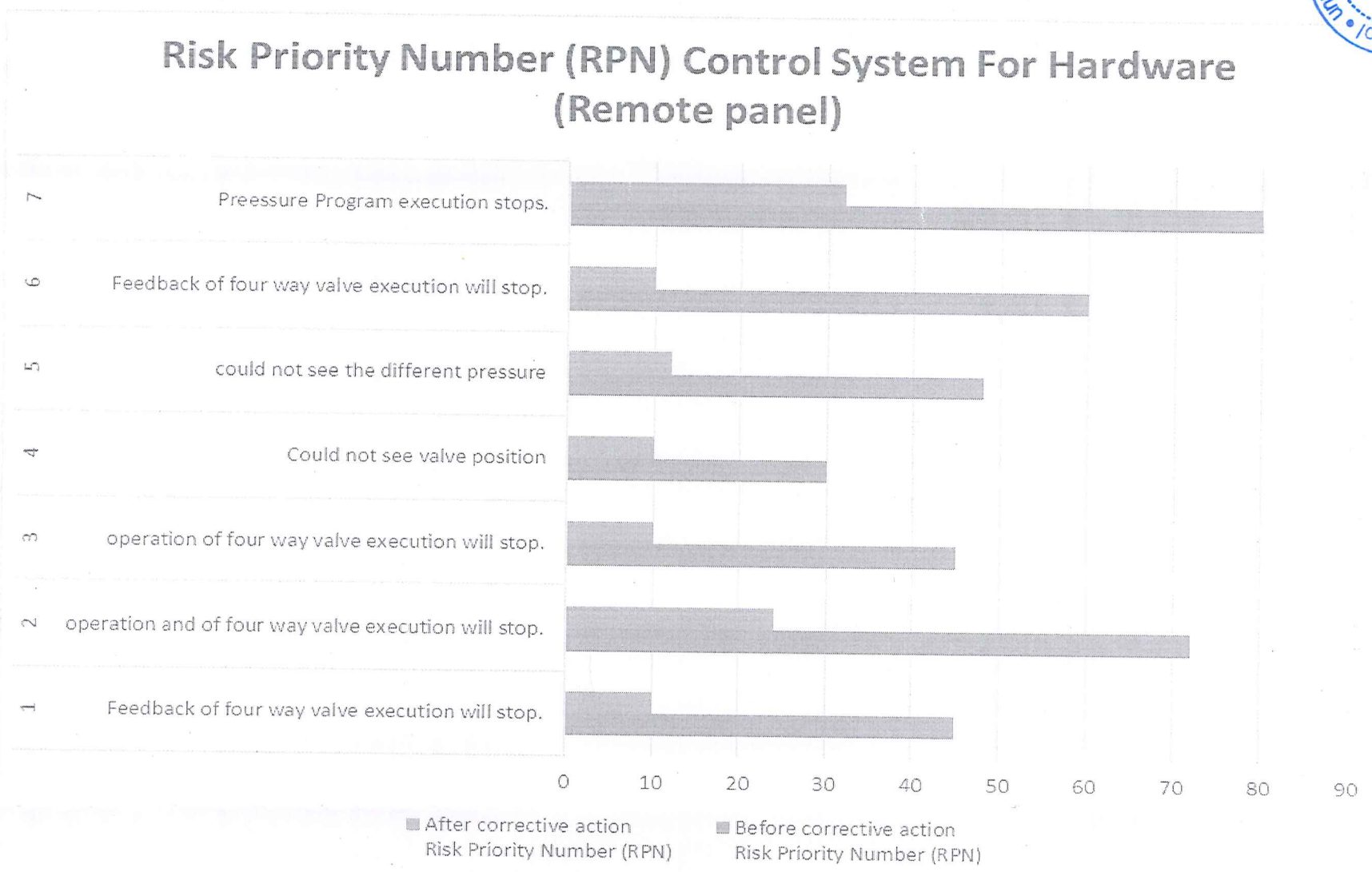
Before Corrective Action														After Corrective Action					
S. No.	Items/ function	Block Type Subroutine	Design Intentions	Failure Mode	Cause	Local Effects	System Effects	Global Effects	Corrective / Recommended Action	Severity	Detection	Probability Of Occurance	Risk Priority Number (RPN)	Current Control	Responsibility	Action Taken and Completion Date	Severity	Detection	Occurance	Risk Priority Number (RPN)
1	Master	Hardware configuration	Remote Operation	Program execution fails to start.	CPU and Modules failure; RAM data corruption; hardware configuration errors at boot not compensated for with diagnostic	PLC goes into STOP mode. Applicable status indicator is lit on CPU module.	loss of ability to operate the BOP RAM/diverter (via remote interface only). Loss of sequencing timing or interlock function; loss of alarm capability; loss of logging capability.	BOP Ram/Diverter will not operate for open/close	diagnose the problem in PLC program fault table/hardware and rectify	5	6	2	60	Operate manualy selector valve from BOP control unit to operate Ram for open/close	PLC programmer	Completed	5	2	1	10
2	Master	Press	Remote Operation	Preessure Program execution stops.	PLC program may be not correct; hardware configuration errors: Analog input module may be faulted or loose	PLC goes into STOP mode. Applicable status indicator is lit on CPU module.	loss of ability to see all the pressure of the BOP /diverter ; loss of alarm capability for pressure ; loss of logging capability of pressure.	Could not see all the pressures of BOP control unot.	diagnose the problem in PLC program/ hardware and rectify	6	7	2	84	Operate manualy selector valve from BOP control unit to operate Ram for open/close	PLC programmer	Completed	6	2	2	24
3	Master	FAULT	Remote Operation	In the event alarm in program execution will stop.	PLC program may be not correct;	Any alarm will not come	loss of ability to come and reset the alarm of the BOP /diverter ;	Could not received the alarm then horn will not blow	diagnose the problem in PLC program and rectify	4	6	2	48	check the PLC program in FAULT block	PLC programmer	Completed	4	2	1	8
4	Master	IP_OP	Remote Operation	operation and feedback of four way valve execution will stop.	Low level hardware failure;Input/ output module may be faulty; data corruption.PLC program may be not correct;	4-way valve will not operate and feedback of valve position will also not execute	Loss of operation capability of 4-way valve.	BOP Ram will not operate for open/close	diagnose the problem and rectify	5	4	3	60	check the PLC program in IP_OP block; also check Input and output module hardware	PLC programmer	Completed	5	2	1	10
5	Master	HOOTER	Remote Operation	In the event horn for alarm in program execution will stop.	PLC program may be not correct;	Horn will not operate	loss of ability to blow the horn when alarm comes in the BOP /diverter control unit;	horn will not blow	diagnose the problem in PLC program and rectify	6	6	2	72	check the PLC program in HOOTER block	PLC programmer	Completed	6	2	2	24
6	Master	VLV_ACT	Remote Operation	In the event of a module or rack loss program execution will stop.	Low level hardware faillure; data corruption or incorrect.	execution of communication of panels will stop	loss of ability to operate the BOP RAM/diverter (via remote interface only). Loss of sequencing timing or interlock function; loss of alarm capability; loss of logging capability.	BOP Ram will not operate for open/close	diagnose the problem in PLC program/ hardware and rectify	8	3	2	48	check the PLC program in VLV_ACT block	PLC programmer	Completed	8	2	1	16

7	Remote panel	Press	Slave Remote Operation	Preessure Program execution stops.	PLC program may be not correct; hardware configuration errors: Analog input module may be faulted or loose	PLC goes into STOP mode. Applicable status indicator is lit on CPU module.	loss of ability to see all the pressure of the BOP /diverter ; loss of alarm capability for pressure ; loss of logging capability of pressure.	Could not see all the pressures of BOP control unot.	diagnose the problem in PLC program/ hardware and rectify	7	5	2	70	Operate manualy selector valve from BOP control unit to operate Ram for open/close	PLC programmer	Completed	7	2	2	28
8	Remote panel	VLV_RST	Slave Remote Operation	In the event reset of alarm in program execution will stop.	PLC program may be not correct;	Any alarm will not reset	loss of ability to reset the alarm of the BOP /diverter ;	Could not reset the alarm then horn will continues blow	diagnose the problem in PLC program and rectify	6	6	2	72	check the PLC program in VLV_RST block	PLC programmer	Completed	6	3	1	18
9	Remote panel	INPUT	Slave Remote Operation	operation and of four way valve execution will stop.	Low level hardware failure;Input module may be faulty; data corruption.PLC program may be not correct;	4-way valve will not execute	Loss of operation capability of 4-way valve.	BOP Ram will not operate for open/close	diagnose the problem and rectify	7	4	3	84	check the PLC program in INPUT block; also check Input and module hardware	PLC programmer	Completed	7	3	1	21
10	Remote panel	OUTPUT	Slave Remote Operation	Feedback of four way valve execution will stop.	Low level hardware failure;output module may be faulty; data corruption.PLC program may be not correct;	Feedback of 4-way valve position will also not execute	Loss of capability to see the position of 4-way valve.	BOP Ram position for open/close could not see	diagnose the problem and rectify	6	5	3	90	check the PLC program in OUTPUT block; also check output module hardware	PLC programmer	Completed	6	2	1	12
11	Remote panel	VLV_CON	Slave Remote Operation	In the event of a module or rack loss program execution will stop.	Low level hardware faillure; data corruption or incorrect.	execution of communication of panels will stop	loss of ability to operate the BOP RAM/diverter (via remote interface only). Loss of sequencing timing or interlock function; loss of alarm capability; loss of logging capability.	BOP Ram will not operate for open/close	diagnose the problem in PLC program/ hardware and rectify	8	6	2	96	check the PLC program in VLV_ACT block	PLC programmer	Completed	8	2	2	32



HARDWARE (REMOTE PANEL)													
Before Corrective Action													
S.No.	Items/ function	Design Intentions	Failure Mode	Cause	Local Effects	System Effects	Global Effects	Corrective / Recommended Action	Severarity	Detection	Probability Of Occurance	Risk Priority Number (RPN)	Curr
1	proximity	Feedback of four way valve position.	Feedback of four way valve execution will stop.	Proximity may be faulty;connection loose between proximity to amplifier	Feedback of 4-way valve position will also not execute	Loss of capability to see the position of 4-way valve.	BOP Ram position for open/close could not see	diagnose the problem and rectify	5	3	3	45	check tl

2	Solenoid valve	operation and of four way valve execution.	operation and of four way valve execution will stop.	solenoid may be faullty	4-way valve will not execute	Loss of operation capability of 4-way valve.	BOP Ram will not operate for open/close	diagnose the problem and rectify	6	4	3	72	check th valve
3	Pushbutton	To operate four way valve.	operation of four way valve execution will stop.	Pushbutton may be faulty	4-way valve will not execute	Loss of operation capability of 4-way valve.	BOP Ram will not operate for open/close	diagnose the problem and rectify	5	3	3	45	check th pushbu
4	Pilot light	To see the valve position	Could not see valve position	LED/pilot light may be faulty	No effect	No effect	No effect	diagnose the problem and rectify	5	3	2	30	check th and LED
5	Digital Gauge	To see the Pressure Value	could not see the different pressure	Digital Gaige may be faulty	No effect	No effect	No effect	diagnose the problem and rectify	6	4	2	48	check th gauge
6	Amplifier	For Amplify the signal.	Feedback of four way valve execution will stop.	Proximity may be faulty;connection loose between proximity to amplifier	Feedback of 4-way valve position will also not execute	Loss of capability to see the position of 4-way valve.	BOP Ram position for open/close could not see	diagnose the problem and rectify	5	4	3	60	check th
7	PLC CPU and it's module	For Process the complete cycle	Preessure Program execution stops.	PLC program may be not correct; hardware configuration errors: Analog input module may be faulted or loose	PLC goes into STOP mode. Applicable status indicator is lit on CPU module.	loss of ability to see all the pressure of the BOP /diverter ; loss of alarm capability for pressure ; loss of logging capability of pressure.	Could not see all the pressures of BOP control unot.	diagnose the problem in PLC program/hardware and rectify	8	5	2	80	Operate selector BOP cor operate open/cl



Annexure 'A'

ASSEMBLY AND TESTING PROCEDURE FOR PLC SLAVE PANEL

MODEL NO:

PLEASE ENSURE THAT THE CHECKLIST IS COMPLETE AND INPUT VOLTAGE CORRECT BEFORE SUPPLYING MAINS POWER

PANEL TYPE : **ENCLOSURE SIZE:**
SALE ORDER NO: **UNIT NO/JOB NO:**
CUSTOMER: **DRAWING NO:**
SERIAL NO SLAVE PANEL:

** **Before starting the work , Make sure drawing is latest**

S.No	System	Practical Value/status	Status	Remark (If any)	Date	Done By	Checked By
1	**PLC** (i)Power Module (AC/DC)..... Input Voltage..... (ii) user interface (HMI)..... (iii) CPU Model.No..... (iv) Number of Input Module and Model No..... (v) Number of Output Module and output module No..... (vi) Number of Analog Input Module (vii) Analog Output Module.No.....						
2	**Redundancy** (iv) Air Type (v) Electrical Type (vi) Communication Type						

S.No	System	Measured Value/Status	Status	Remark (If any)	Date	Done By	Checked By
	(ii) Electrical Type (iii) Communication Type						
3	**Timing** **(i)** PLC Power UP Timing **(ii)** Software Response Time **(iii)** Hot Standby Failover time (If Installed) (iv) EDS timing **(iv)** alarm activation delays						
4	**Sequencing** (i) Yes/No						
5	**Automation** (i) Yes/No						
6	**Interlocks** (i) Electrical.....(Yes/No) (ii) Air.....(Yes/No)						
7	**Alarm Management** (i) Yes/No..... (ii) Audible Sound.....(Yes/No) (iii) Visual Sound.....(Yes/No) (iv) Proper sound Produced.....(Yes/No)						
8	**Error Management** (i)Pressure Gauge Reading.....(Ok/Not Ok) (ii) PLC Error .....(Yes/No) (iii) Communication Error.....(Yes/No) (iv) Valve oprtaion Error .....(Yes/No) (v) Valve position Error.....(Yes/No)						

S.No	System	Measured Value/Status	Status	Remark (If any)	Date	Done By	Checked By
9	**Event Logging and historical archiving** (i) Data Accurate.... (Yes/No)						
10	**Initialization** (i) PLC Power Up Time (ii)PLC Program Boot up time						
11	**External Interface** (i) Memory Card						
12	**Operator Configuration Capabilities** (i)Yes/No						
13	**Mode of communication-** (i) Modbus/Ethernet/Optical Fiber/ Wireless						
14	Input / Output module wiring						
15	Output module wiring						
16	Mount Back plate W/O component on enclosure, check alignment, straightness & fitment on nuts and Bolts.						
17	Model No. Main Power Supply (SMPS) ---- I/P Voltage..... O/P Voltage.....						
18	Check tightness of Cooler Serial Number.....						
19	Y -Purge installed with a cover (bracket)						
20	Model No of Y Purge----------						
21	Purge Testing at.....PSI Purge Timing.....Min						

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S.No	System	Measured Value/Status	Status	Remark (If any)	Date	Done By	Checked By
22	Relief vent Serial Number.....						
23	Spark arrester installed and checked circlip is fixed over orifice Orifice Number--------						
24	Communication Gland no..... qty.....size						
25	Motor Power Gland size.....						
26	Pilot light for Alarm Qty..... Colour.....						
27	Push Button for lamp test..... Colour ..... Number.....						
28	Push Button for Reset..... Colour..... Number.....						
29	Solenoid valves of 6mm Qty.....						
30	Solenoid valves for Hold to operate of 8 mm Qty------						
31	Battery connection done with wire size of -------- mm						
32	Serial number of all the transducers installed Manifold Transducers..... Annular Transducers..... Accumulator Trasnducers..... Rig Air Trasnducers.....						
33	Float switch connection done						
34	Main Inpit volt-------VAC, Freq------Hz / Volt-------VDC						

S.No	System	Measured Value/Status	Status	Remark (If any)	Date	Done By	Checked By
35	Motor run and fluid level connections with safety barriers done at positions Modal Number----------qty.....						
36	Check tightness of battery terminals voltage------ AH----, Make--------						
37	Earthing at all the required points done.						
38	Output Voltage from power supply has been adjusted to approx 26.5VDC						
39	Numbering of TB Is done in accordance with the drawings						
40	Interconnnection for data communication between Master and Driller are according to drawing .						
41	Cable used for Power connection is of.....AWG						
42	All screw are tightened up with the help of **lock washer**						
43	Horn Serial Number ---------						
	PLC Software testing with control system hardware						
44	Verify all Input/Output status of valve						
45	Verify all alarms status						
46	Verify all Pressure reading status Vs. Pressure Transducer						

Workmanship rating----------

/ Satisfactory / Not satisfactory/ Needs improvement /.

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If not then

Why.....

TESTED BY (Sign/Date) **ASSEMBLY PERSONNEL**

_____ _____

WITNESSED BY (Sign/Date) **Q C INSPECTOR (Sign/Date)**

_____ _____

Annexure 'A'

ASSEMBLY AND TESTING PROCEDURE FOR PLC SLAVE PANEL

MODEL NO:

PLEASE ENSURE THAT THE CHECKLIST IS COMPLETE AND INPUT VOLTAGE CORRECT BEFORE SUPPLYING MAINS POWER

PANEL TYPE : **ENCLOSURE SIZE:**
SALE ORDER NO: **UNIT NO/JOB NO:**
CUSTOMER: **DRAWING NO:**
SERIAL NO SLAVE PANEL:

** **Before starting the work , Make sure drawing is latest**

S.No	System	Practical Value/status	Status	Remark (If any)	Date	Done By	Checked By
1	**PLC** (i) Power Module (AC/DC)..... Input Voltage..... (ii) CPU Model.No..... (iii) Number of Input Module and Model No..... (iv) Number of Output Module and output module No..... (iv) Number of Analog Input Module (v) Analog Output Module.No....._____							
2	**Redundancy** (iv) Air Type (v) Electrical Type (vi) Communication Type							

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S.No	System	Practical Value/status	Status	Remark (If any)	Date	Done By	Checked By
3.	**(c) Timing** (i) PLC Power up Time (ii) Software Response Time (iii) Recovery time (iv) Hot Standby Failover time (If Installed) (v) alarm activation delays						
4	**Sequencing** (i) Yes/No						
5	**Automation** (i)Yes/No						
6	**Interlocks** (i) Electrical.....(Yes/No) (ii) Air.....(Yes/No)						
7	**Alarm Management** (i) Yes/No..... (ii) Audible Sound.....(Yes/No) (iii) Visual Sound.....(Yes/No) (iv) Proper sound Produced.....(Yes/No)						
8	**Error Management** (i)Pressure Gauge Reading.....(Ok/Not Ok) (ii) PLC Error .....(Yes/No) (iii) Communication Error.....(Yes/No) (iv) Valve oprtaion Error .....(Yes/No) (v) Valve position Error.....(Yes/No)						
9	**Event Logging and historical**						

S.No	System	Practical Value/status	Status	Remark (If any)	Date	Done By	Checked By
	archiving (i) Data Accurate.... (Yes/No)						
10	**Initialization** (i) PLC Power Up Time (ii)PLC Program Boot up time						
11	**External Interface** (i)USB Port (ii)Memory Card (iii)Printer						
12	**Operator ConfigurationCapabilities** (i)Yes/No						
13	**Mode of communication-** (i) Modbus/Ethernet/Optical Fiber/ Wireless						
14	Input module wiring						
15	Output module wiring						
16	Mount Back plate W/O component on enclosure, check alignment, straightness & fitment on nuts and Bolts.						
17	Mounting of CPU I /P and O/P on base plate. Power supply S.No:_____ CPU Module.No.:_____ Input Module.No.---------- Output Module No----------						
18	Analog O/P Module.No._____						

S.No	System	Practical Value/status	Status	Remark (If any)	Date	Done By	Checked By
19	Model number of Main Power Supply (SMPS) ---- I/P Voltage..... O/P Voltage.....						
20	Check tightness of Battery terminal..... voltage....VDC,----------AH.						
21	Communication connector QTY..... Color.....						
22	Push button with green light Indicator Qty_____Nos.						
23	Push button with red light Indicator Qty_____Nos.						
24	ON/OFF switch (Direction , Cap)						
25	Pilot light (alarm) Qty_____Nos. Color _____						
26	Push button lamp test Number..... Color.....						
27	Pilot light (Communication. Error) Qty_____ Nos. Color_____						
28	Pilot light (low rig air press.) Qty_____Nos. Color _____						
29	Push button Acknowledge Number..... Color_____						
30	Pilot light of alarms Qty_____Nos. Color _____						
31	Pilot light (motor run) Qty_____Nos Color _____						
32	Blind/Shear Cover Open /Closed properly .....(Yes/No)						

S.No	System	Practical Value/status	Status	Remark (If any)	Date	Done By	Checked By
33	Digital Pressure Gauge Model No..... Qty.....						
34	Verify Earthing at all the required points done						
35	Output Voltage from Power supply has been adjusted to approx 26.5VDC						
36	Cable used for input and output modules wiring is of .....AWG Size of the wire used.....mm						
37	Serial No of Y Purge installed..... Purge Testing at.....PSI						
38	Spark arrester installed and checked circlip is fixed over orifice Orifice Number--------						
39	Relief vent Serial.No....						
40	All screw are tightened up with the help of Lock washer.						
41	Numbering of TB is done in accordance with the drawings						
42	All screw are tightened up with the help of **lock washer**						
43	Horn Model Number --------						
	PLC Software testing with control system hardware						
44	Verify all Input/Output status of valve						
45	Verify all alarms status						
46	Verify all Pressure reading status Vs. Pressure Transducer						

Workmanship rating----

/ Satisfactory / Not satisfactory/ Needs improvement /.

If not then

Why.....

TESTED BY (Sign/Date) **ASSEMBLY PERSONNEL**

_____ _____

WITNESSED BY (Sign/Date) **Q C INSPECTOR (Sign/Date)**

_____ _____

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Annexure 'B'

SOFTWARE FUNCTION PROCEDURE FOR PLC MASTER PANEL

MODEL NO:

PLEASE ENSURE THAT THE CHECKLIST IS COMPLETE AND INPUT VOLTAGE CORRECT BEFORE SUPPLYING MAINS POWER

PANEL TYPE : **ENCLOSURE SIZE:**
SALE ORDER NO: **UNIT NO/JOB NO:**
CUSTOMER: **DRAWING NO:**
SERIAL NO MASTER PANEL:

** **Before starting the work , Make sure drawing is latest**

S.No	System	Practical Value	Status	Remark (If any)	Date	Done By	Checked By
1	**PLC Basic Feature** (i) CPU **Model** Number..... **(ii)** Type of Programming..... **(iii)** Floating Point(real) data function.....**(Yes/No)** **(iv)** Non-Volatilie flash memory for Program Storage **(v)** Battery Backup for program,RTC.....**(Yes/No)** **(vi)** Run/Stop Switch.....**(Yes/No)** **(vii)** Number of RS232 Port..... Number of RS-485 Port..... **(viii)** Carrier Style.....						

S.No	System	Practical Value	Status	Remark (If any)	Date	Done By	Checked By
2	**Mode of communication-** Modbus/Ethernet/Optical Fiber/ Wireless Communication						
3	**PLC Operational Timing** **(i)** PLC Power Up Time **(ii)** Software Response Time **(iii)** Recovery time **(iv)** Hot Standby Failover time (If Installed) **(v)** alarm activation delays						
4	**PLC CPU LED Status** (i) POWER (ii) O.k. (iii) RUN (iv)FAULT (v) FORCE (vi) PORT 1 (vii) PORT 2						
5	**PLC Operation timing** **(i)** All control valve operation performed properly..... **(ii)** All alarm operaton performed properly..... **(iii)** One Control Valve Exectuion Time						
6	**PLC Alarm Timing** (i) Communication Error (ii)Low Fluid Level (iii)Low Accumulator Pressure (iv)Blind/Shear Cover Open (v)Mains Fail (vi) Alarm when operation is not						

S.No	System	Practical Value	Status	Remark (If any)	Date	Done By	Checked By
	performed.....(Yes/No).....Time						
	PLC Software testing with control system hardware						
7	Verify all Input/Output status of valve						
8	Verify all alarms status						
9	Verify all Pressure reading status Vs. Pressure Transducer						

Workmanship rating----

/ Satisfactory / Not satisfactory/ Needs improvement /.

If not then

Why.....

TESTED BY (Sign/Date)

ASSEMBLY PERSONNEL

WITNESSED BY (Sign/Date)

Q C INSPECTOR (Sign/Date)

Annexure 'B'

SOFTWARE FUNCTION PROCEDURE FOR PLC SLAVE PANEL

MODEL NO:

PLEASE ENSURE THAT THE CHECKLIST IS COMPLETE AND INPUT VOLTAGE CORRECT BEFORE SUPPLYING MAINS POWER

PANEL TYPE :
SALE ORDER NO:
CUSTOMER:
SERIAL NO SLAVE PANEL:

ENCLOSURE SIZE:
UNIT NO/JOB NO:
DRAWING NO:

** **Before starting the work , Make sure drawing is latest**

S.No	System	Measured Value/Status	Status	Remark (If any)	Date	Done By	Checked By
1	**PLC Basic Feature** (i) CPU Model Number..... **(ii)** Type of Programming..... **(iii)** Floating Point(real) data function.....**(Yes/No)** **(iv)** Non-Volatilie flash memory for Program Storage **(v)** Battery Backup for program,RTC.....**(Yes/No)** **(vi)** Run/Stop Switch.....**(Yes/No)** **(vii)** Number of RS232..... Number of RS-485 Communication---------- **(viii)** Carrier Style.....							

S.No	System	Measured Value/Status	Status	Remark (If any)	Date	Done By	Checked By
2	**Mode of communication-** Modbus/Ethernet/Optical Fiber/ Wireless (i) Ethernet Restart Push Button....**(Yes/No)** (ii)Ethernet Data transmission.....						
3	**Timing** **(i)** PLC Power Up Time **(ii)** Software Response Time **(iii)** Recovery time **(iv)** Hot Standby Failover time (If Installed) (v) alarm activation delays						
4	**PLC CPU Input/Output/Analog module/ LED Status** (i) SF (ii) BF (iii) DC5V (iv)FRCE (v) RUN (vi) STOP						
5	**PLC Operation timing** **(i)** All control valve operation performed properly..... **(ii)** All alarm operaton performed Properly..... **(iii)** One Control Valve Exectuion Time.....						
6	**PLC Alarm Timing** (i) Communication Error (ii)Low Fluid Level (iii)Low Accumulator Pressure (iv)Blind/Shear Cover Open						

Annexure 'E'

SOFTWARE/HARDWARE CODE REVIEW FOR PLC MASTER PANEL

MODEL NO:

PLEASE ENSURE THAT THE CHECKLIST IS COMPLETE AND INPUT VOLTAGE CORRECT BEFORE SUPPLYIN MAINS POWER

PANEL TYPE : **ENCLOSURE SIZE:**
SALE ORDER NO: **UNIT NO/JOB NO:**
CUSTOMER: **DRAWING NO:**
SERIAL NO MASTER PANEL:

** **Before starting the work , Make sure drawing is latest**

Pressure Switch No	Plc input	Plc Input addressing	HPU INPUT	Terminal Block No	Solenoid No	Plc output No	PLC Output addressing	HPU OUTPUT	Terminal Block NO

S.No	System	Measured Value/Status	Status	Remark (If any)	Date	Done By	Checked By
	(v)Mains Fail (vi) Operation fail Alarm .....(Yes/No)						
	PLC Software testing with control system hardware						
7	Verify all Input/Output status of valve						
8	Verify all alarms status						
9	Verify all Pressure reading status Vs. Pressure Transducer						

Workmanship rating----

/ Satisfactory / Not satisfactory/ Needs improvement /.

If not then

Why.....

TESTED BY (Sign/Date)

_____

ASSEMBLY PERSONNEL

_____

WITNESSED BY (Sign/Date)

_____

Q C INSPECTOR (Sign/Date)

_____

CPC OILFIELD PRIVATE LIMITED
ENGINEERING DEPTT.
SOFTWARE VALIDATION PROCEDURE BOP CONTROL UNIT
FOR JOB NO.

Supersedes:

NEW

Pressure Switch No	Plc input	Plc Input addressing	HPU INPUT	Terminal Block No	Solenoid No	Plc output No	PLC Output addressing	HPU OUTPUT	Terminal Block NO

Workmanship rating----

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/ Satisfactory / Not satisfactory/ Needs improvement /.

If not then

TESTED BY (Sign/Date) _____

ASSEMBLY PERSONNEL _____

WITNESSED BY (Sign/Date) _____

Q C INSPECTOR (Sign/Date) _____

Annexure 'E'

SOFTWARE/HARDWARE CODE REVIEW FOR PLC SLAVE PANEL

MODEL NO:

PLEASE ENSURE THAT THE CHECKLIST IS COMPLETE AND INPUT VOLTAGE CORRECT BEFORE SUPPLYIN MAINS POWER

PANEL TYPE :
SALE ORDER NO:
CUSTOMER:
SERIAL NO SLAVE PANEL:

ENCLOSURE SIZE:
UNIT NO/JOB NO:
DRAWING NO:

** **Before starting the work , Make sure drawing is latest**

Pressure Switch No	Plc input	Plc Input addressing	REMOTE INPUT	Terminal Block No	Solenoid No	Plc output No	PLC Output addressing	REMOTE OUTPUT	Terminal Block NO

Pressure Switch No	Plc input	Plc Input addressing	REMOTE INPUT	Terminal Block No	Solenoid No	Plc output No	PLC Output addressing	REMOTE OUTPUT	Terminal Block NO

Workmanship rating----

/ Satisfactory / Not satisfactory/ Needs improvement /.

If not then

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TESTED BY (Sign/Date)

_____

ASSEMBLY PERSONNEL

_____

WITNESSED BY (Sign/Date)

_____

Q C INSPECTOR (Sign/Date)

_____

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Annexure 'F'

MASTER SOFTWARE SECURITY REVIEW PROCEDURE FOR PLC MASTER PANEL

MODEL NO:

PLEASE ENSURE THAT THE CHECKLIST IS COMPLETE AND INPUT VOLTAGE CORRECT BEFORE SUPPLYING MAINS POWER

PANEL TYPE :
SALE ORDER NO:
CUSTOMER:
SERIAL NO MASTER PANEL:

ENCLOSURE SIZE:
UNIT NO/JOB NO:
DRAWING NO:

** **Before starting the work , Make sure drawing is latest**

S.No	System	Measured Value/Status	Status	Remark (If any)	Date	Done By	Checked By
1	**PLC System Software** (i) PLC User Name/Password.....(Yes/No) (ii) PLC Program write in Flash memory.....(Yes/No) (iii) PLC Software Vaildate.....(Yes/No)						

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Workmanship rating----

/ Satisfactory / Not satisfactory/ Needs improvement /.

If not then

Why.....

TESTED BY (Sign/Date)

_____

ASSEMBLY PERSONNEL

_____

WITNESSED BY (Sign/Date)

_____

Q C INSPECTOR (Sign/Date)

_____

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Annexure 'F'

SLAVE PANEL SOFTWARE SECURITY REVIEW PROCEDURE FOR PLC SLAVE PANEL

MODEL NO:

PANEL TYPE :
SALE ORDER NO: `
CUSTOMER:
SERIAL NO SLAVE PANEL:

ENCLOSURE SIZE:
UNIT NO/JOB NO:
DRAWING NO:

** **Before starting the work , Make sure drawing is latest**

S.No	System	Measured Value/Status	Status	Remark (If any)	Date	Done By	Checked By
1	**PLC System Software** (i) PLC User Name/Password.....(Yes/No) (ii) PLC Program write in Flash memory.....(Yes/No) (iii) PLC Software Vaildate.....(Yes/No)						

Workmanship rating----

/ Satisfactory / Not satisfactory/ Needs improvement /.

If not then

Why.....

TESTED BY (Sign/Date)

_____

ASSEMBLY PERSONNEL

_____

WITNESSED BY (Sign/Date)

_____

Q C INSPECTOR (Sign/Date)

_____

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Annexure 'H'

PLC PROGRAMME TRACEABILITY RECORD

S. No	SOFTWARE PLATFORM	EDITION NO.	DATE	TIME	PLC PROGRAM NO.	REVISION NO	UNIT NO.	REASON OF CHANGE	RESPONSIABLE PERSON	REMARKS

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