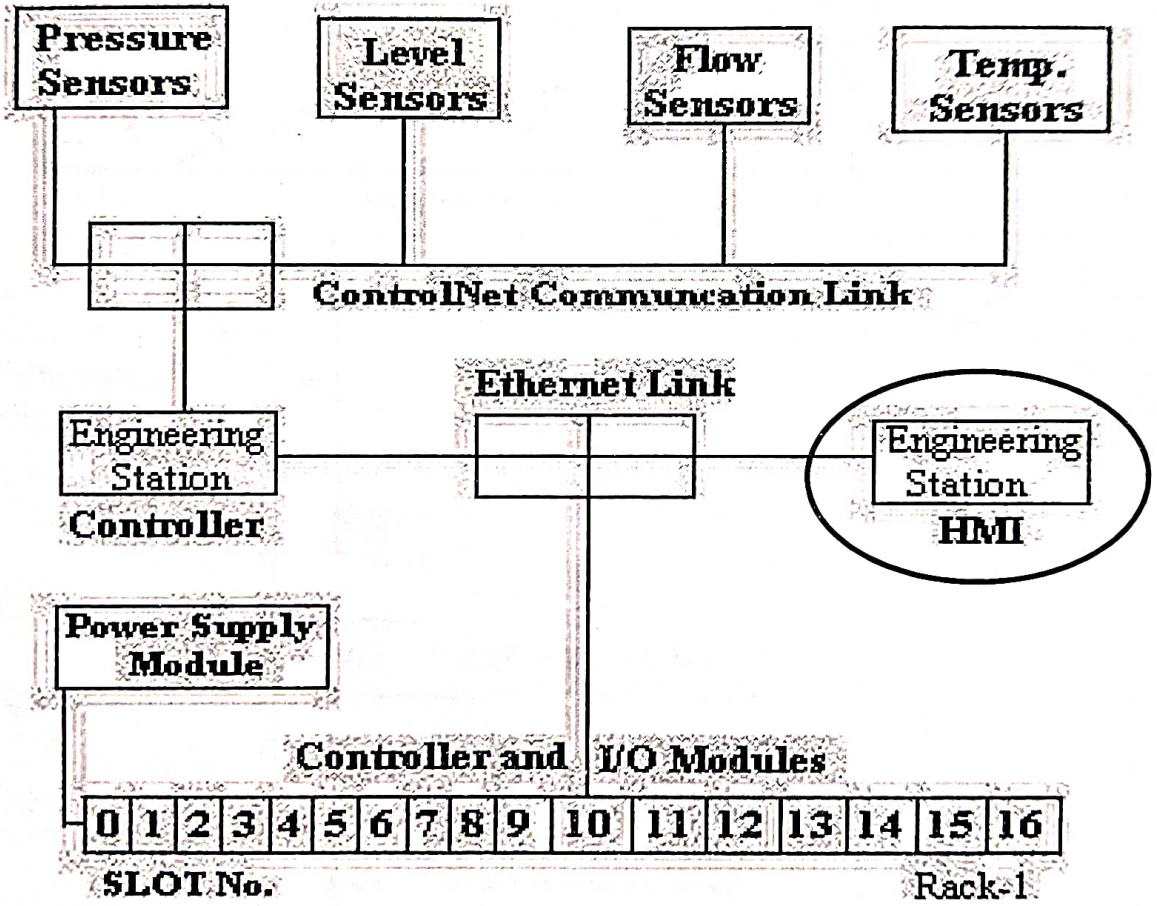
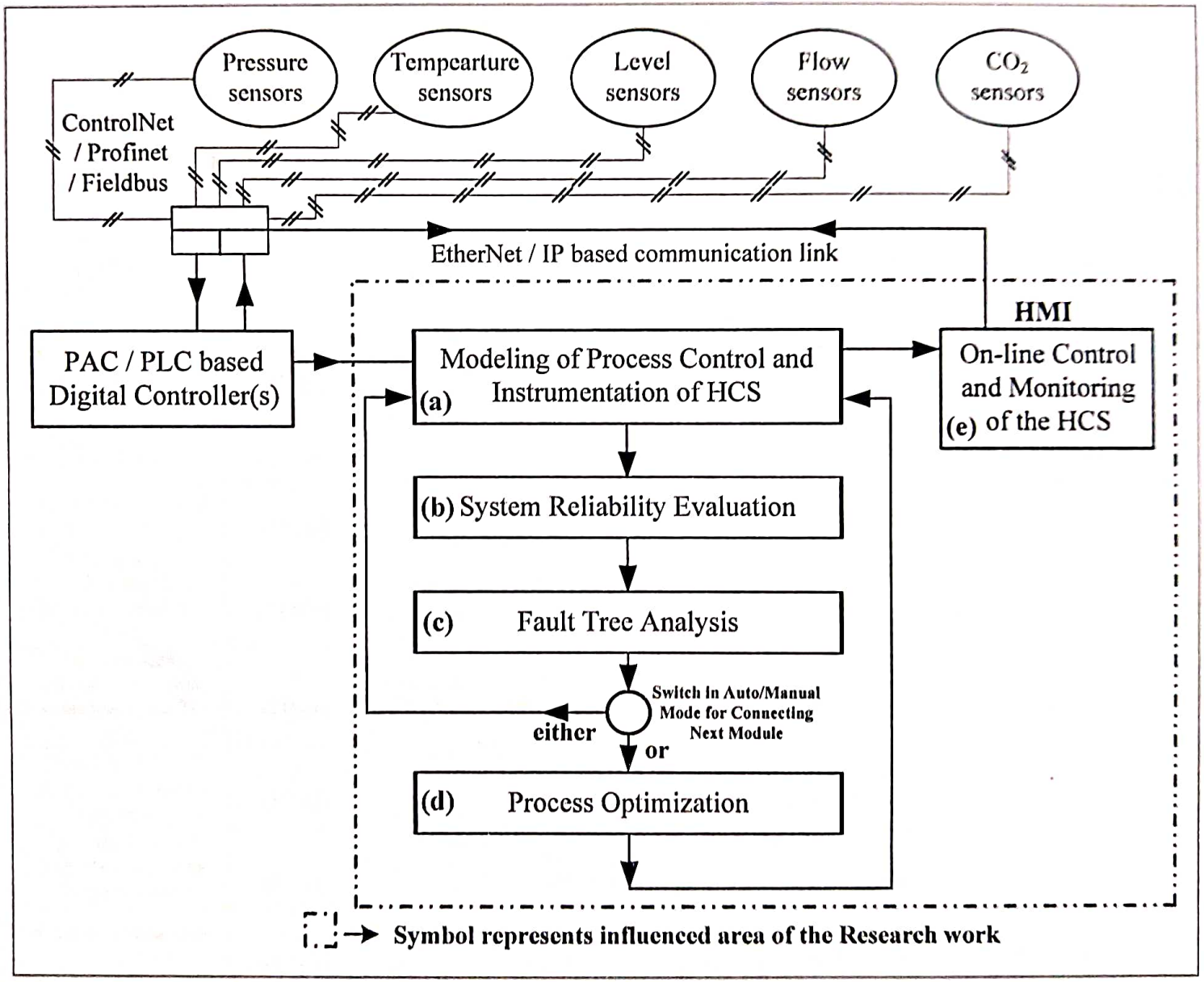
System Architecture of Hydrogen Cooling System



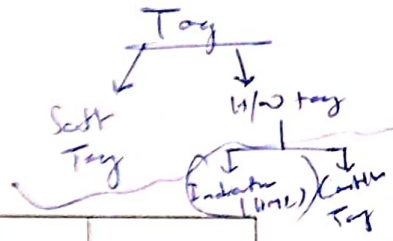
Lay out of Integrated Cooling System



ANNUXURE I

SCADA Tags

"HMI_Soft Tags-Ladder Diagram"



Tag No.	Service	Component	Inst. Range (Engg. / Calibrated Range)	Connection To / From	Signal I / P	Signal O / P	Calibrated as (Module & Slot No.)	Note (Tag Type)	Set Point SP	Reading under actual Conditions
LI83B	Level Indicator of Tank T-83B	I (HMI)	0-100% (0-760 Hg mm)	At HMI	---	---	Device Tag, Local:8:I.Ch0Data	S/W (Controller)	--	
LI83C	Level Indicator of Tank T-83C	I (HMI)	0-100% (0-760 Hg mm)	At HMI	---	---	Device Tag, Local:8:I.Ch2Data	S/W (Controller)	--	
PI83_1	Pressure Indicator of Argon Vaporizer	I (HMI)	0-100%	At HMI	---	---	Device Tag, Local:8:I.Ch4Data	S/W (Controller)	--	
TI83A_1	Temperature Indicator of Reservoir Tank T-83A	I (HMI)	0-100% (0-100^0 C)	At HMI	---	---	Device Tag, Local:12:I.Ch0Data	S/W (Controller)	--	
TI83_1	Temperature Indicator of Argon vaporizer Tank T-83A	I (HMI)	0-100% (0-100^0 C)	At HMI	---	---	Device Tag, Local:12:I.Ch1Data	S/W (Controller)	--	
FI83_1	Flow Indicator of Argon vaporizer in Existing unit	I (HMI)	0-100% (0-700 Nm^3 hr)	At HMI	---	---	Device Tag, Local:8:I.Ch5Data	S/W (Controller)	--	
FI83_2	Flow Indicator of Argon vaporizer in Proposed unit	I (HMI)	0-100% (0-700 Nm^3 hr)	At HMI	---	---	Device Tag, Local:8:I.Ch6Data	S/W (Controller)	--	
PI83B	Pressure Indicator of Tank T-83B	I (HMI)	0-100% (0-40 Kg/cm^2)	At HMI	---	---	Device Tag, Local:8:I.Ch1Data	S/W (Controller)	--	

Note: This Instrument List is the integral part of SCADA as fas as interfacing of Control Centre (HMI and main server/Controller) with RTUs is concerned. Therefore this annuxure is important component of HCS, and required to convert simulated model into real-time process.

PI83C	Pressure Indicator of Tank T-83C	I (HMI)	0-100% (0-40 Kg/cm^2)	At HMI	---	---	Device Tag, Local:8:I.Ch3Data	S/W (Controller)	--	
RSV_ACK	Acknowledge from RSViewSE	HMI	---	From HMI	--	--	DIGITAL_IN[2].4	ACK (Alarm Tag)	--	
RSV_RESET	Reset to RSViewSE	HMI	---	From HMI	--	--	DIGITAL_IN[2].5	RESET (Alarm Tag)	--	
HS83B_1	Push button for Inlet valve UV83B-1	HMI	---	From HMI	---	---	---	S/W	--	
HS83B_2	Push button for Outlet valve UV83B-2	HMI	---	From HMI	---	---	---	S/W	--	
HS83C_1	Push button for Inlet valve UV83C-1	HMI	---	From HMI	---	---	---	S/W	--	
HS83C_2	Push button for Outlet valve UV83C-2	HMI	---	From HMI	---	---	---	S/W	--	
HS833_1	Push button for Outlet valve UV833-1 of Heat Exchanger HE833A	HMI	---	From HMI	---	---	---	S/W	--	
HS833_2	Push button for Outlet valve UV833-2 of Heat Exchanger HE833A	HMI	---	From HMI	---	---	---	S/W	--	

Controller Tags (Required for Real Time only)

"AI_MAP-Ladder Diagram"

- The card & slot number cited for reference only and exact to be mentioned after configuring RTU or IED (PLC based) Controller with field sensors and HMI via RSViewSE. Ladder Logic design method is consider for programming of Hydrogen Cooling System (which is, presently out of scope from project work).

Note: This Instrument List is the integral part of SCADA as fas as interfacing of Control Centre (HMI and main server/Controller) with RTUs is concerned. Therefore this annuxure is important component of HCS, and required to convert simulated model into real-time process.

Tag No.	Service	Component	Inst. Range (Engg. / Calibrated Range)	Connection To / From	Signal I / P	Signal O / P	Card & Slot no. (Of PLC)	Data Sheet	Make	Model	Note (Tag Type)	Set Point (SP)	Reading under actual Conditions
PT83_1	Pressure of Heat Exchanger	T	0-40 Kg/cm^2	From Field	0-40 Kg/cm^2	4-20 mA	Local:8:I.Ch4 Data	Data Sheet of Plant/ Section	ROSEMOUNT	3051	H/W	--	
PT83B	Pressure of Tank T-83B	T	0-40 Kg/cm^2	From Field	0-40 Kg/cm^2	4-20 mA	Local:8:I.Ch1 Data				H/W	--	
PT83C	Pressure of Tank T-83C	T	0-40 Kg/cm^2	From Field	0-40 Kg/cm^2	4-20 mA	Local:8:I.Ch3 Data				H/W	--	
LT83B	Level of Tank T-83B	T	0-16000 mm water column	From Field	0-16000 mm water column	4-20 mA	Local:8:I.Ch0 Data				H/W	--	
LT83C	Level of Tank T-83C	T	0-16000 mm water column	From Field	0-16000 mm water column	4-20 mA	Local:8:I.Ch2 Data				H/W	--	
FT83_1	Flow at outlet of Heat Exchanger of HE833A or HE833B	T	0-700 Nm^3/hr	From Field	0-700 Nm^3/hr	4-20 mA	Local:8:I.Ch5 Data				H/W	--	
FT83_2	Flow at outlet of Heat Exchanger of HE834A or HE834B	T	0-700 Nm^3/hr	From Field	0-700 Nm^3/hr	4-20 mA	Local:8:I.Ch6 Data				H/W	--	

Note: This Instrument List is the integral part of SCADA as fas as interfacing of Control Centre (HMI and main server/Controller) with RTUs is concerned. Therefore this annuxure is important component of HCS, and required to convert simulated model into real-time process.

Tag No.	Service	Component	Inst. Range (Engg. / Calibrated Range)	Connection To / From	Signal I / P	Signal O / P	Card & Slot no. (Of PLC)	Data Sheet	Make	Model	Note (Tag Type)	Set Point SP	Reading under actual Conditions
TT83A_1	Temperature of Reservoir at HSU	T	0-100^0 C	From Field	0-100^0 C	4-20 mA	Local:12:I.Ch0Data	--	--	--	H/W	--	
TT83_1	Temperature of outlet of Heat Exchanger of HE833A or HE833B	T	0-100^0 C	From Field	0-100^0 C	4-20 mA	Local:12:I.Ch1Data				H/W	--	
ZT83B_1	Position of pressure valve PV83B-1 of Tank T-83B	T /Control Valve	0-100%	From Field	0-100%	4-20 mA	Local:8:I.Ch7Data	Valve Make			H/W	--	
ZT83B_2	Position of pressure valve PV83B-2 of Tank T-83B	T /Control Valve	0-100%	From Field	0-100%	4-20 mA	Local:8:I.Ch8Data				H/W	--	
ZT83C_1	Position of pressure valve PV83C-1 of Tank T-83C	T /Control Valve	0-100%	From Field	0-100%	4-20 mA	Local:8:I.Ch9Data				H/W	--	
ZT83C_2	Position of pressure valve PV83C-2 of Tank T-83C	T /Control Valve	0-100%	From Field	0-100%	4-20 mA	Local:8:I.Ch10Data				H/W	--	

Note: This Instrument List is the integral part of SCADA as fas as interfacing of Control Centre (HMI and main server/Controller) with RTUs is concerned. Therefore this annuxure is important component of HCS, and required to convert simulated model into real-time process.

"PLC_Soft Tags-Ladder Diagram"

Tag No.	Service	Component	Inst. Range (Engg. / Calibrated Range)	Connection To / From	Signal I / P	Signal O / P	Card & Slot no. (Of PLC)	Data Sheet	Make	Model	Note (Tag Type)	Set Point SP	Reading under actual Conditions
PIC83B_1	Pressure oller of Tank T-83B at Low Pressure	I / Controller	0-100% (0-40 Kg/cm^2)	At Controller	4-20 mA	0-100%	---	Data Sheet of Plant /Section	Rockwell Automation	--	S/W	2.0	
PIC83B_2	Pressure Indication Controller of Tank T-83B at High Pressure	I / Controller	0-100% (0-40 Kg/cm^2)	At Controller	4-20 mA	0-100%	---				S/W	31.5	
PIC83C_1	Pressure Indication Controller of Tank T-83C at Low Pressure	I / Controller	0-100% (0-40 Kg/cm^2)	At Controller	4-20 mA	0-100%	---				S/W	2.0	
PIC83C_2	Pressure Indication Controller of Tank T-83C at High Pressure	I / Controller	0-100% (0-40 Kg/cm^2)	At Controller	4-20 mA	0-100%	---				S/W	31.5	

Note: This Instrument List is the integral part of SCADA as fas as interfacing of Control Centre (HMI and main server/Controller) with RTUs is concerned. Therefore this annuxure is important component of HCS, and required to convert simulated model into real-time process.

"DI_MAP-Ladder Diagram"

Tag No.	Service	Component (On/Off Valve)	Inst. Range (Engg. / Calibrated Range)	Connection To / From	Signal I / P	Signal O / P	Card & Slot no. (Of PLC)	Data Sheet	Make	Model	Note (Tag Type)	Set Point SP	Reading under actual Conditions
ZSL83A_1 DIGITAL_IN[0].0	Inlet valve of IC Line from HSU of reservoir T83A is Close	BV	---	From Field	---	---	Local:3:I.Data.0	--	Rockwell Automation	--	H/W (Controller)	--	
ZSH83A_1 DIGITAL_IN[0].1	Inlet valve of IC Line from HSU of reservoir T83A is Open	BV	---	From Field	---	---	Local:3:I.Data.1				H/W (Controller)	--	
ZSL83A_2 DIGITAL_IN[0].2	Outlet valve of IC Line from HSU of reservoir T83A is Close	BV	---	From Field	---	---	Local:3:I.Data.2				H/W (Controller)	--	
ZSH83A_2 DIGITAL_IN[0].3	Outlet valve of IC Line from HSU of reservoir T83A is Open	BV	---	From Field	---	---	Local:3:I.Data.3				H/W (Controller)	--	
ZSL83A_3 DIGITAL_IN[0].4	SIVL from HSU is Close	BV	---	From Field	---	---	Local:3:I.Data.4				H/W (Controller)	--	
ZSH83A_3 DIGITAL_IN[0].5	SIVL from HSU is Open	BV	---	From Field	---	---	Local:3:I.Data.5				H/W (Controller)	--	
ZSL83B_1 DIGITAL_IN[0].6	Inlet valve of Tank T-83B is Close	IV	---	From Field	---	---	Local: 3:I.Data.6				H/W (Controller)	--	

Note: This Instrument List is the integral part of SCADA as fas as interfacing of Control Centre (HMI and main server/Controller) with RTUs is concerned. Therefore this annuxure is important component of HCS, and required to convert simulated model into real-time process.

TALL83_1_ANN	Annunciation of Heat Exchanger at Very High (Hydrogen Separation Unit)	A (Controller)	---	At Controller	--	--	DIGITAL_IN[1].16				S/W (Alarm Tag)		

"AO_MAP-Ladder Diagram"

Tag No.	Service	Component	Inst. Range (Engg. / Calibrated Range)	Connection To / From	Signal I / P	Signal O / P	Card & Slot no. (Of PLC)	Data Sheet	Make	Model	Note (Tag Type)	Set Point SP	Reading under actual Conditions
PIC83B_1.OUT	Pressure Indication Controller of Tank T-83B to field	Controller	0-100%	At Controller	0-100%	4-20 mA	Local:10:O.Ch0Data	Data Sheet of Plant/Section	Rockwell Automation	--	S/W	2.0	
PIC83B_2.OUT	Pressure Indication Controller of Tank T-83B to field	Controller	0-100%	At Controller	0-100%	4-20 mA	Local:10:O.Ch1Data				S/W	31.5	
PIC83C_1.OUT	Pressure Indication Controller of Tank T-83C to field	Controller	0-100%	At Controller	0-100%	4-20 mA	Local:10:O.Ch2Data				S/W	2.0	
PIC83C_2.OUT	Pressure Indication Controller of Tank T-83C to field	Controller	0-100%	At Controller	0-100%	4-20 mA	Local:10:O.Ch3Data				S/W	31.5	

Note: This Instrument List is the integral part of SCADA as fas as interfacing of Control Centre (HMI and main server/Controller) with RTUs is concerned. Therefore this annuxure is important component of HCS, and required to convert simulated model into real-time process.

"DO_MAP-Ladder Diagram"

Tag No.	Service	Component (On/Off Valve)	Inst. Range (Engg. / Calibrated Range)	Connection To / From	Signal I / P	Signal O / P	Card & Slot no. (Of PLC)	Data Sheet	Make	Model	Note (Tag Type)	Set Point SP	Reading under actual Conditions
UV83B_1	Digital O/P of Inlet Valve Tank T-83B	R	---	To Field	Open / Close	ON / OFF	Local:6:O.Data.0	--	Rockwell Automation	--	H/W	--	
UV83B_2	Digital O/P of Outlet Valve Tank T-83B	R	---	To Field	Open / Close	ON / OFF	Local:6:O.Data.4				H/W	--	
UV83C_1	Digital O/P of Inlet Valve Tank T-83C	R	---	To Field	Open / Close	ON / OFF	Local:6:O.Data.1				H/W	--	
UV83C_2	Digital O/P of Outlet Valve Tank T-83C	R	---	To Field	Open / Close	ON / OFF	Local:6:O.Data.2				H/W	--	
UYV833_1	Digital O/P of Heat Exchanger outlet (HE833B) is Close	R	---	To Field	Open / Close	ON / OFF	Local:6:O.Data.6				H/W	--	
UYV833_2	Digital O/P of Heat Exchanger outlet (HE833B) is Close	R	---	To Field	Open / Close	ON / OFF	Local:6:O.Data.7				H/W	--	
HOOTER_ ALM	Hooter Alarm	A / R	---	To Field	Open / Close	ON / OFF	Local:6:O.Data.15				H/W	--	

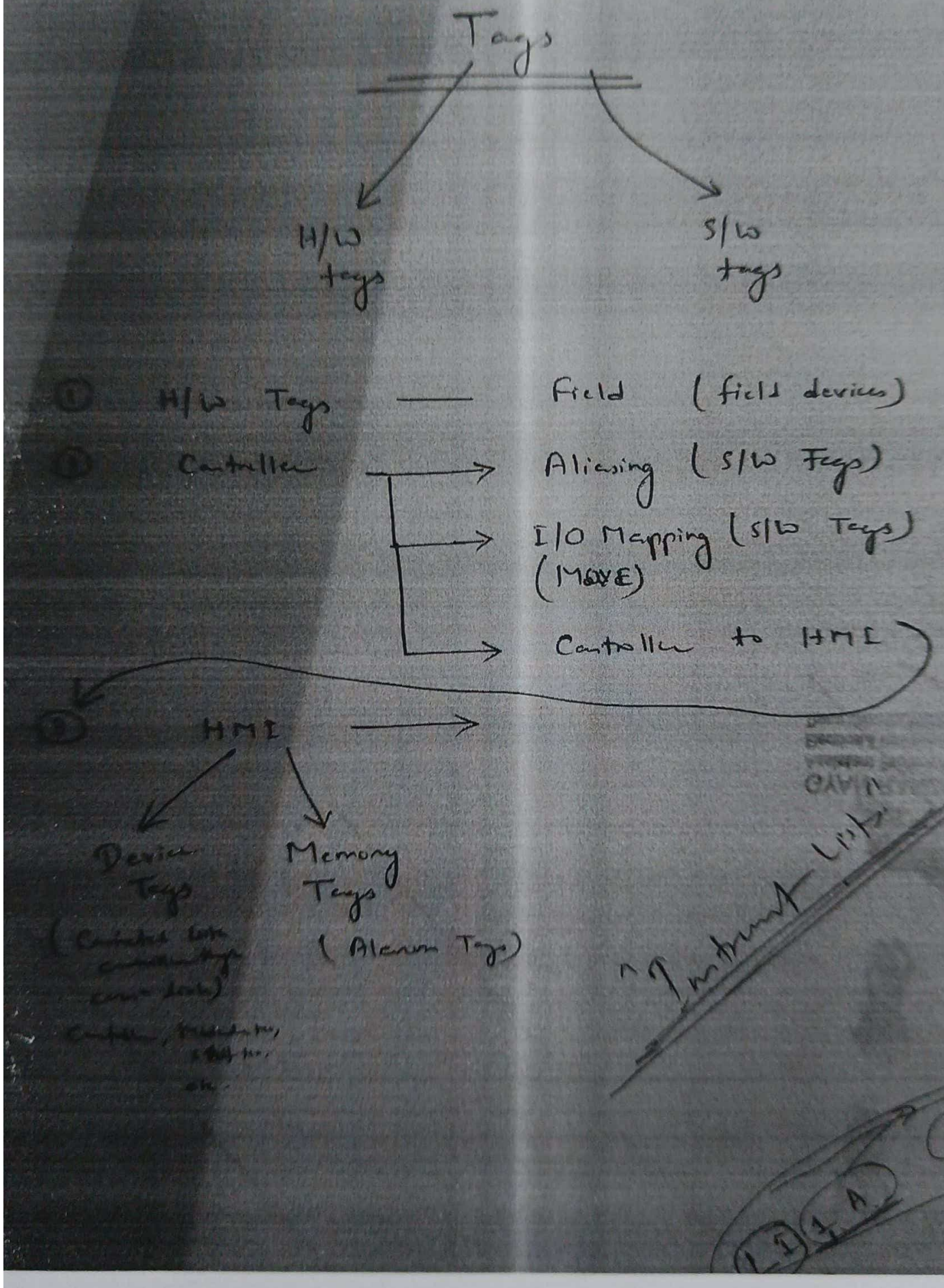
"Internally Generated Tags-Ladder Diagram"

Tag No.	Prepare	Source routine	Card & Slot no. (Of PLC)	Note	Used in
T83B_FILLING_PERMIT	Filling permitted of Tank T-83B	Controller		S/W	Controller

Note: This Instrument List is the integral part of SCADA as fas as interfacing of Control Centre (HMI and main server/Controller) with RTUs is concerned. Therefore this annuxure is important component of HCS, and required to convert simulated model into real-time process.

Abbreviations: As per The P/I Diagram	
mA- mille Ampere	HSU: Hydrogen Separation Unit
16000 mm Water Column = 760 Hg Column = 11.5 Meters in vertical height	BV- Ball Valve
Level measurement: 16000 mm Water Column = 100 Set Point	IV- Inlet Valve and OV- Outlet Valve
Pressure measurement: 36 kg/cm^2 = 36 Set Point	IC- Insulated Line
A- Alarm	SIVL- Super Insulated Vacuum Line
T- Transmitter	L- L for Valve Low / Close
R- Receiver	H- H for Valve High / Open
CV- Control Valve	UV83B-1: Inlet Valve (ON/OFF type) of Tank T-83B
PV- Pressure Valve	UV83B-2: Outlet Valve (ON/OFF type) of Tank T-83B
I- I indicate that component belongs to HMI/PLC/DCS	UV83C-1: Inlet Valve (ON/OFF type) of Tank T-83C
HS83: Push button / Pressure switch series – Soft Tags for HMI	UV83C-2: Outlet Valve (ON/OFF type) of Tank T-83C

Note: This Instrument List is the integral part of SCADA as fas as interfacing of Control Centre (HMI and main server/Controller) with RTUs is concerned. Therefore this annuxure is important component of HCS, and required to convert simulated model into real-time process.


Tags
H/W tags
S/W tags
1 H/W Tags
Field (field devices)
2 Controller
Aliasing (S/W Tags)
I/O Mapping (S/W Tags) (MOVE)
Controller to HMI
3 HMI
Device Tags
Memory Tags
(Alarm Tags)

Explosion-proof enclosures :

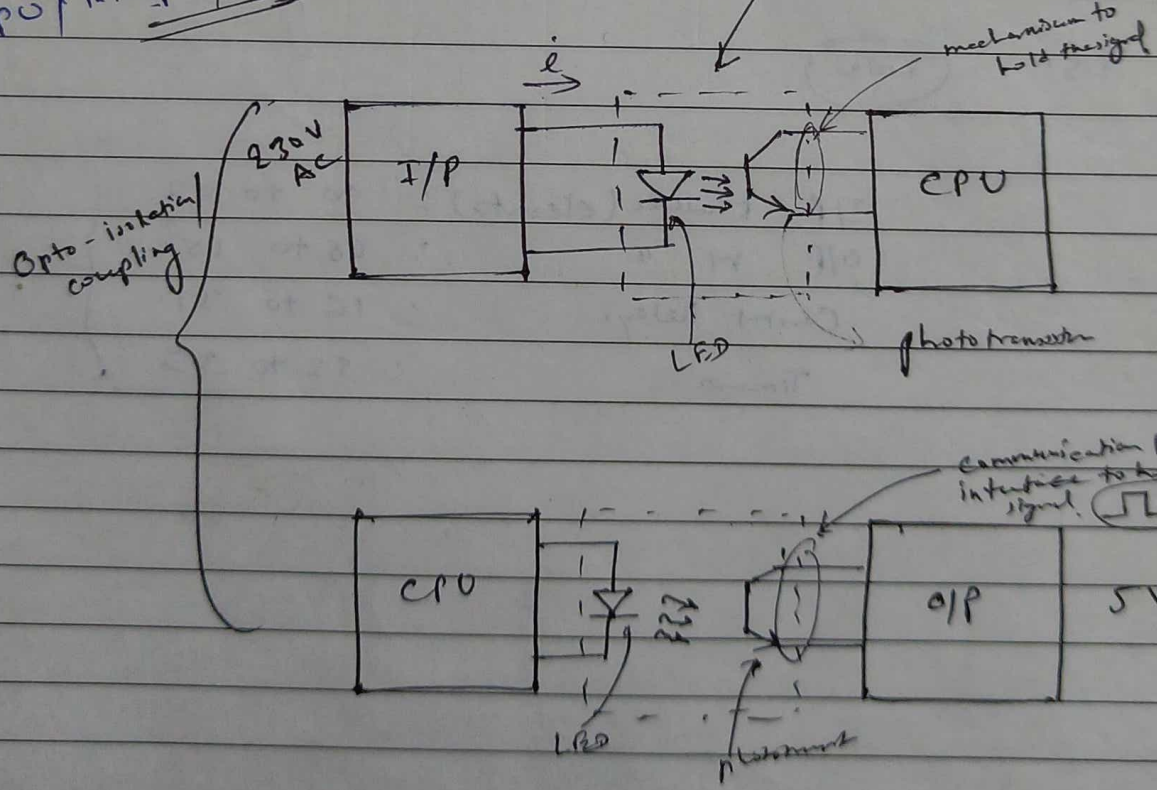
- Pressurized (purged) enclosures
  - → Thermal / convection cooling
  - → Near-ambient cooling
  - → Below-ambient cooling

"High-power & Low-power interface"

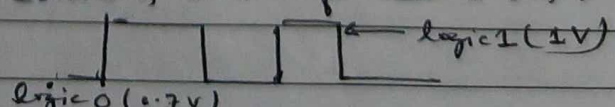
① prevents CPU from unauthorized supplies

② for safety of CPU / i/p side

→ "Opto-electric isolation"

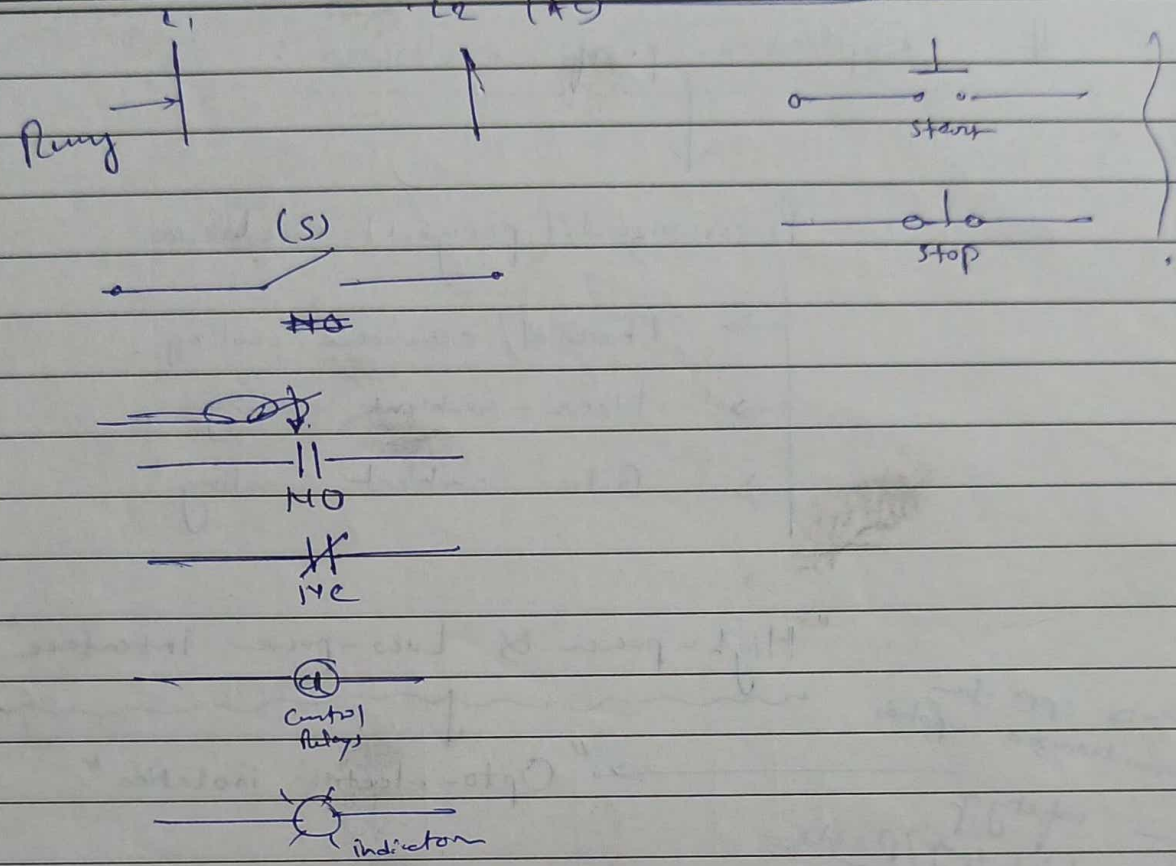


* Voltage in between Collector & Emitter of LED is 0.7 V



PLC

Instrumentation Symbols



ISA: Visio

I/P Module (elements)	:	00 to 07
O/P M 4	:	08 to 15
Control Relays	:	16 to 31
Timers	:	32 to 39