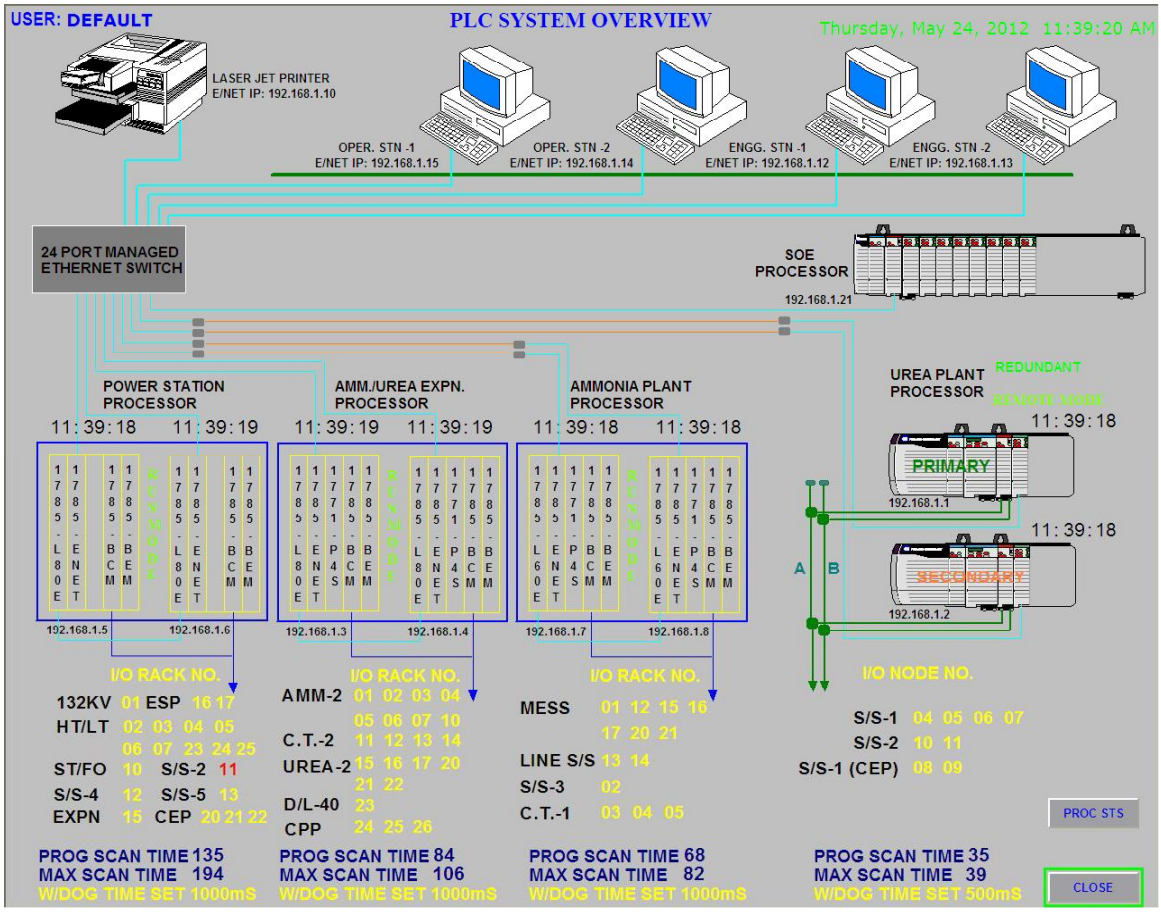
Important Aspects of LMS PLC



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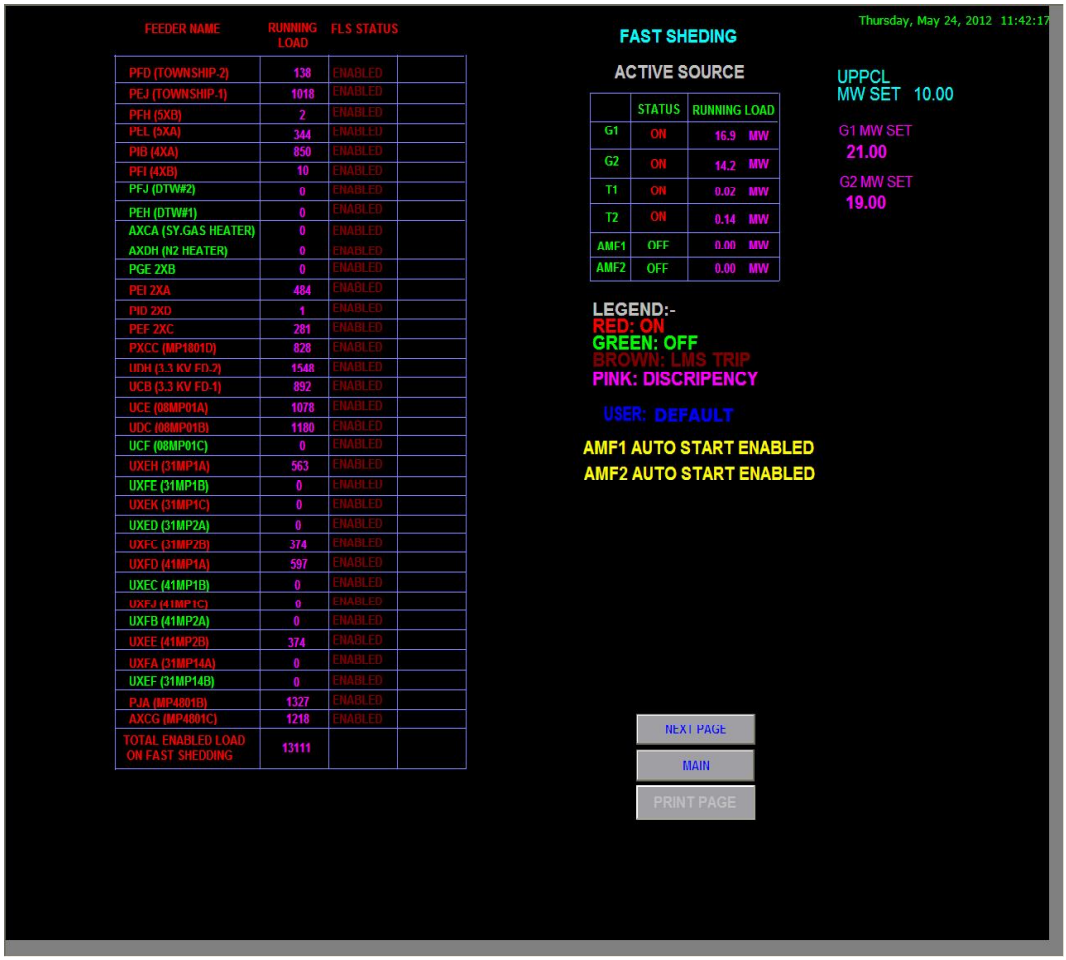
Typical Steps of LMS



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FAST SHEDING

FEEDER NAME	RUNNING LOAD	FLS STATUS	
PFD (TOWNSHIP-2)	138	ENABLED	
PEJ (TOWNSHIP-1)	1018	ENABLED	
PFH (5XB)	2	ENABLED	
PEL (5XA)	344	ENABLED	
PIB (4XA)	850	ENABLED	
PFI (4XB)	10	ENABLED	
PFJ (DTW#2)	0	ENABLED	
PEH (DTW#1)	0	ENABLED	
AXCA (SY.GAS HEATER)	0	ENABLED	
AXDH (N2 HEATER)	0	ENABLED	
PGE 2XB	0	ENABLED	
PEI 2XA	484	ENABLED	
PID 2XD	1	ENABLED	
PEF 2XC	281	ENABLED	
PXCC (MP1801D)	828	ENABLED	
UDH (3.3 KV FD-2)	1548	ENABLED	
UCB (3.3 KV FD-1)	892	ENABLED	
UCE (08MP01A)	1078	ENABLED	
UDC (08MP01B)	1180	ENABLED	
UCF (08MP01C)	0	ENABLED	
UXEH (31MP1A)	563	ENABLED	
UXFE (31MP1B)	0	ENABLED	
UXEK (31MP1C)	0	ENABLED	
UXED (31MP2A)	0	ENABLED	
UXFC (31MP2B)	374	ENABLED	
UXFD (41MP1A)	597	ENABLED	
UXEC (41MP1B)	0	ENABLED	
UXFJ (41MP1C)	0	ENABLED	
UXFB (41MP2A)	0	ENABLED	
UXEE (41MP2B)	374	ENABLED	
UXFA (31MP14A)	0	ENABLED	
UXEF (31MP14B)	0	ENABLED	
PJA (MP4801B)	1327	ENABLED	
AXCG (MP4801C)	1218	ENABLED	
TOTAL ENABLED LOAD ON FAST SHEDDING	13111		

ACTIVE SOURCE

	STATUS	RUNNING LOAD
G1	ON	16.9 MW
G2	ON	14.2 MW
T1	ON	0.02 MW
T2	ON	0.14 MW
AMF1	OFF	0.00 MW
AMF2	OFF	0.00 MW

UPPCL
MW SET 10.00

G1 MW SET
21.00

G2 MW SET
19.00

LEGEND:-
RED: ON
GREEN: OFF
BROWN: LMS TRIP
PINK: DISCRIPENCY

USER: DEFAULT

AMF1 AUTO START ENABLED
AMF2 AUTO START ENABLED

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Detailed Analysis :

On detailed analysis following facts were discovered:

- The digital link between Power Plant Processor to Urea Plant Processor of the existing LMS often suffered from traffic congestions leading to unpredictable delayed actions.
- Scan time of PLC as a whole often run into seconds not milli seconds.
- Our GTGs can take a maximum step load of **4MW** and then settle for at least one minute to take further load and so on upto a maximum of around **19MW.**
- In our Power system "the critical fault clearing time is around 0.32 seconds"(320ms).—In other words the LMS must clear the overloading of GTG ,if any, within 320 ms. maintaining less than 4MW load step and 19MW limit.

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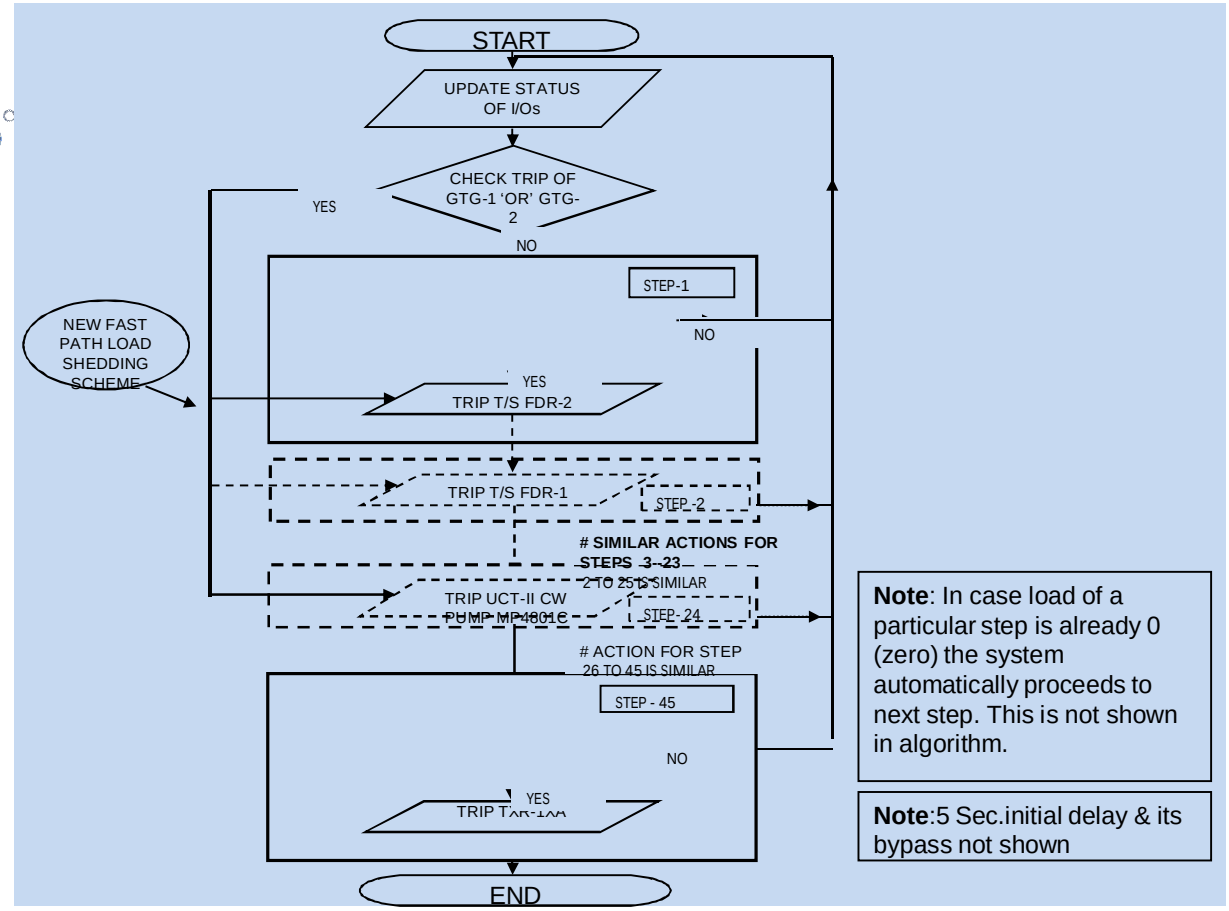
Conceptualisation of corrective measures

- It possible only when all the four Urea Plant loads along-with some other non critical load (total about 13MW) is shed **at a time in less** than 320 ms. by a so called **"Fast load shedding scheme"** acting as a bypass to existing software algorithm**.**
- Transfer of trip command from Power Plant Processor to Urea Plant Processor can be done on hardwired connections as an analog contact to avoid data links and delay thereof.

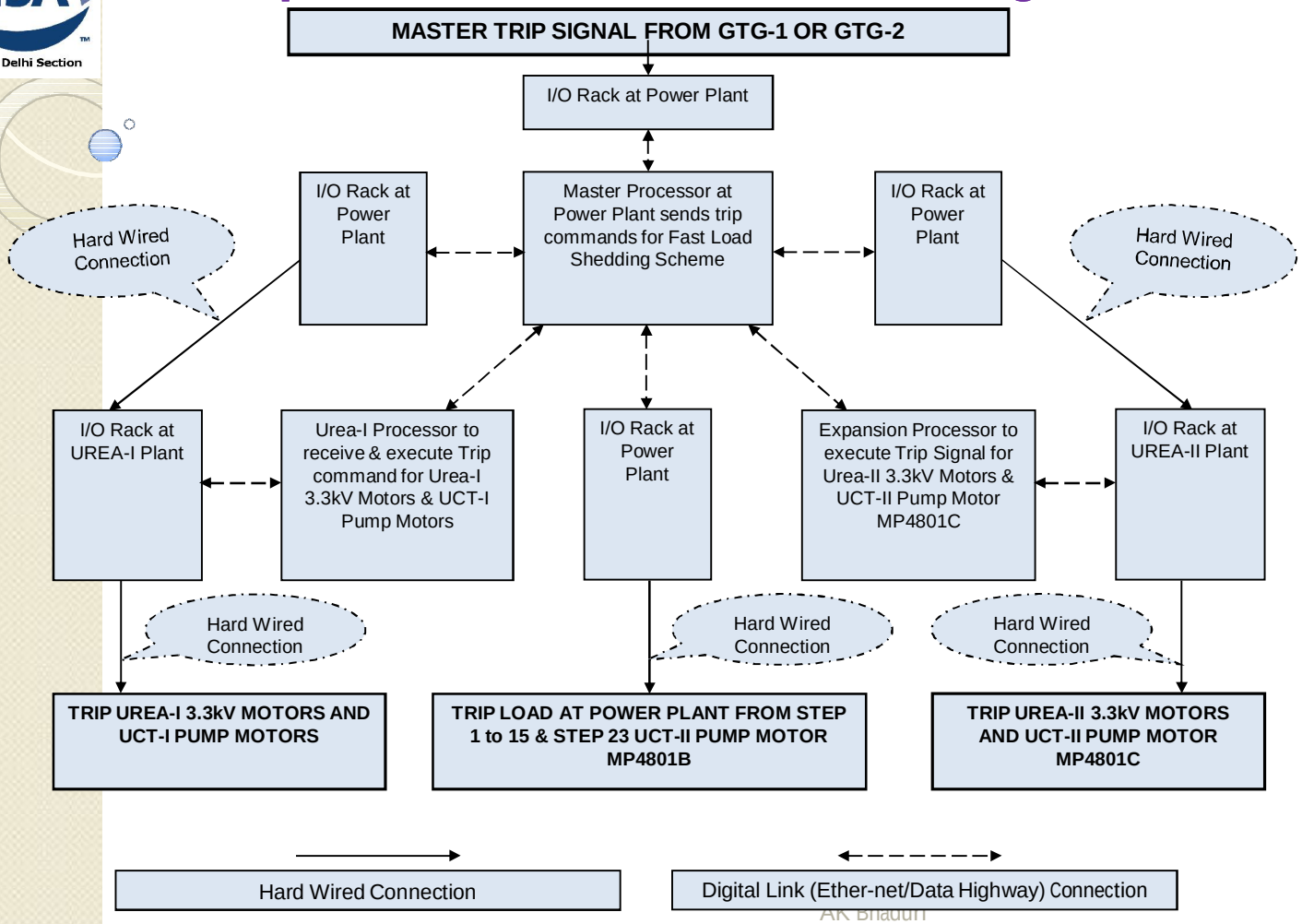
The Fast Path Logic



Note: In case load of a particular step is already 0 (zero) the system automatically proceeds to next step. This is not shown in algorithm.

Note:5 Sec.initial delay & its bypass not shown

Implementation of Fast Path Logic



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Implementation

In the existing PLC, the fast path load shedding implementation scheme was done in line with above concept in steps.

- During this phase the sub-routine was made separately.
- The I/O channel communication rate for power plant and expansion racks for Fast Load Shedding(FLS) I/O was changed from 57.6K to 230.4Kbps for faster execution .
- All the steps as required by fast path scheme were implemented completely.
- The testing was done by way of simulating the fast path load shedding conditions and ensuring actuation of the auxiliary relay upstream of respective circuit breakers.
- The detail of the scan time as measured are also given below.

Implementation-Measured Scan Times

Processor	Scantime before adjustment (ms)	Scantime after adjustment (ms)	Remarks
Power Plant	250	90-120	
Expansion	120	60-70	
Overall(atU2 I/O Rack)		**220-250ms**	**Reqd.320ms**

System scan time was found **220-250ms.** as required

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Implementation—Other Measures

Other measures were also taken to ensure earlier causes of GT trip does not re-occur, nor the utilities like cooling water or lube oil fails to the critical rotary machines.

Also a list of equipment to be run to survive ammonia plants under power crisis situations were made and scenario of process and equipments under such situation was also worked out. Operating instructions were given accordingly.

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Under frequency relay back-up

FEEDER NAME	FEEDER TRIPPED
PFD (TOWNSHIP-2)	NO
PEJ (TOWNSHIP-1)	NO
PFJ (DTW#2)	NO
PEH (DTW#1)	NO
PIB (4XA)	NO
PFI (4XB)	NO
PFH (5XB)	NO
PEL (5XA)	NO
UDH (3.3 KV FD-2)	NO
UCB (3.3 KV FD-1)	NO
UCE (08MP01A)	NO
UDC (08MP01B)	NO
UCF (08MP01C)	NO
UXEH (31MP1A)	NO
UXFE (31MP1B)	NO
UXEK (31MP1C)	NO
UXED (31MP2A)	NO
UXFC (31MP2B)	NO
UXFD (41MP1A)	NO
UXEC (41MP1B)	NO
UXFJ (41MP1C)	NO
UXFB (41MP2A)	NO
UXEE (41MP2B)	NO
UXFA (31MP14A)	NO
UXEF (31MP14B)	NO
AXCG (MP4801C)	NO
PJA (MP4801B)	NO

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Other Measures for Reliability enhancement

It was noted that both GTGs have earlier tripped on occasions of earth fault of Township overhead cables and earth faults at Ammonia-I sub station.

- The earth fault relay installed earlier at Township used to act slower than protection relay installed at GTG end and allowed the fault to propagate to GTGs and trip them. For some period the Township load was removed from GTGs and kept on UPPCL.

- New Microprocessor based MICOM relays are now installed for feeder protection of Ammonia Plant, Bore-well and Township Feeders for fast isolation of fault,