CONTROLLING WITH *PROFIBUS* IN WASTE WATER

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Dubai Municipality

STP INTRODUCTION

- To avoid overflow in existing STP at Al Warsan, Dubai Municipality has conceived new STP at Jabel Ali
- JASTP is designed to treat 300,000 m3/d with a process peak of 480,000 m3/d
- The plant provides tertiary treated effluent for irrigation use, and treated sludge as soil conditioner and fertilizer

PLANT CHARACTERSTICS

❖Capacity 300,000 M3 per day.

❖Conventional activated sludge process with tertiary filtration.

❖UV disinfection and post chlorination.

❖Main Effluent pumping station.

❖One of the biggest Odor plants 150,000m3/h with bio-scrubbers and chemical scrubbers, which covers all pre-treatment and primary treatment.

❖Sludge Drying plant with 10t H2O per hour evaporating capacity with three belt drying lines

PROCESS OVERVIEW

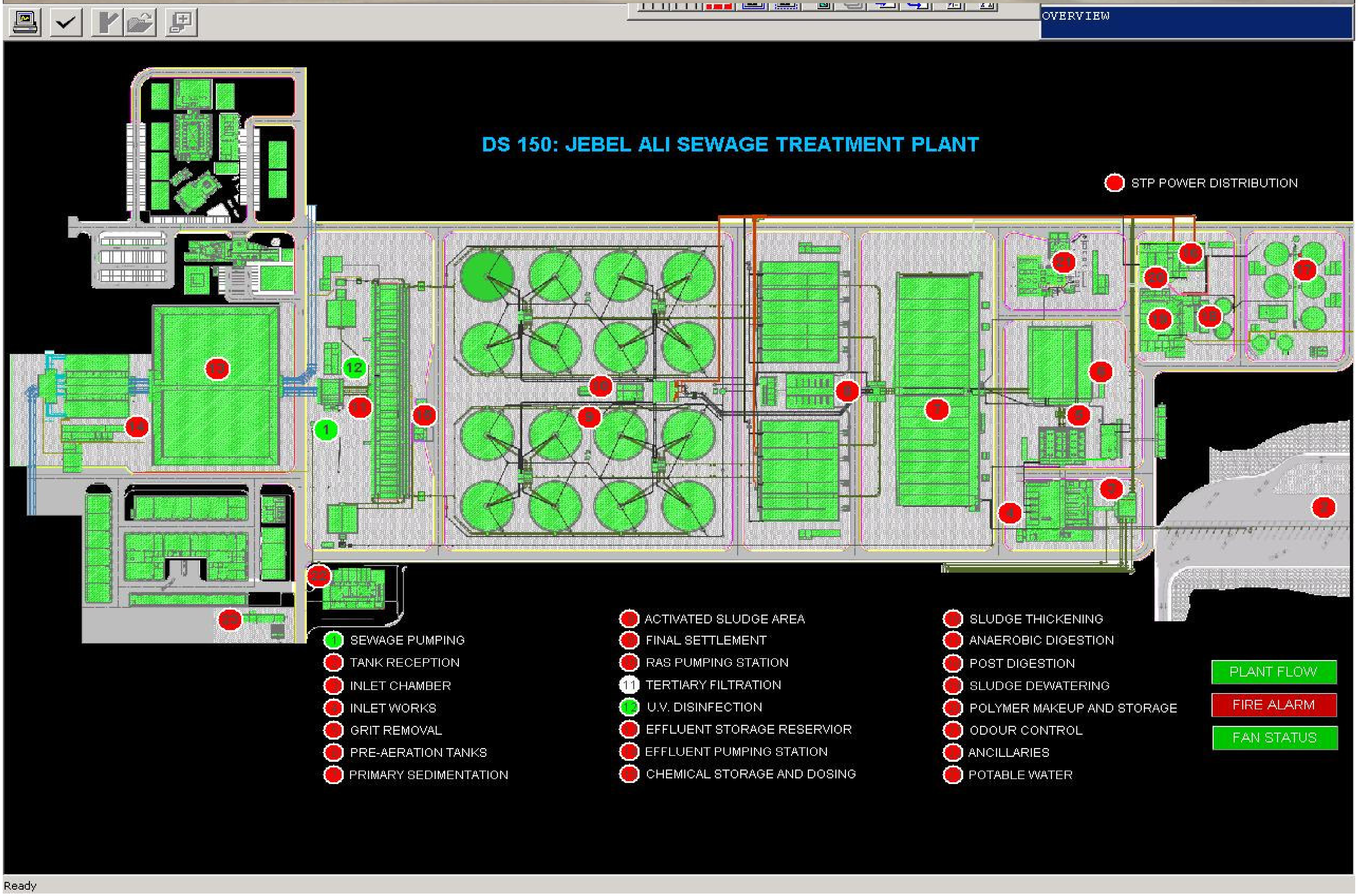
- Any Sewage source consists of three main components namely : Sludge, Liquid and Gas. The treatment in the STP concerns the three elements in different stages.
- The initial treatment is mechanical treatment, inclusive of : Solids screening, Grit Removal and Solids reduction.
- The second stage is the biological treatment. This is also termed as “Activation”.

- The tertiary treatment, involves the filtration and disinfection. The final effluent is pumped to the city for various purposes.
- The sludge, that is separated in the primary and secondary stage is processed in the sludge treatment facility.
- Major activities of the Sludge treatment are : Thickening, Digestion, Dewatering and Drying.
- The malodorous gases from the different treatment stages , are separately processed in a state of the art Odour control facility, with Biological and Chemical Scrubbers before it is discharged into the atmosphere.

PROCESS VISUALIZING

- OVERVIEW
- INLET HEAD WORKS
- AERATED GRIT CHANNELS
- PRE-AERATION
- PRIMARY SEDIMENTATION
- ACTIVATED SLUDGE REACTORS
- FINAL SETTLEMENT TANKS
- RAS PUMPING STATION
- TERTIARY FILTERATION
- UV DISINFECTION
- EFFLUENT PUMPING STATION
- CHLORINATION PLANT
- SLUDGE TREATMENT
- ANERBIC DIGESTION
- SLUDGE DRYING AND DE-WATERING PLANT
- ODOUR CONTROL

PLANT OVERVIEW



TANKER RECEPTION

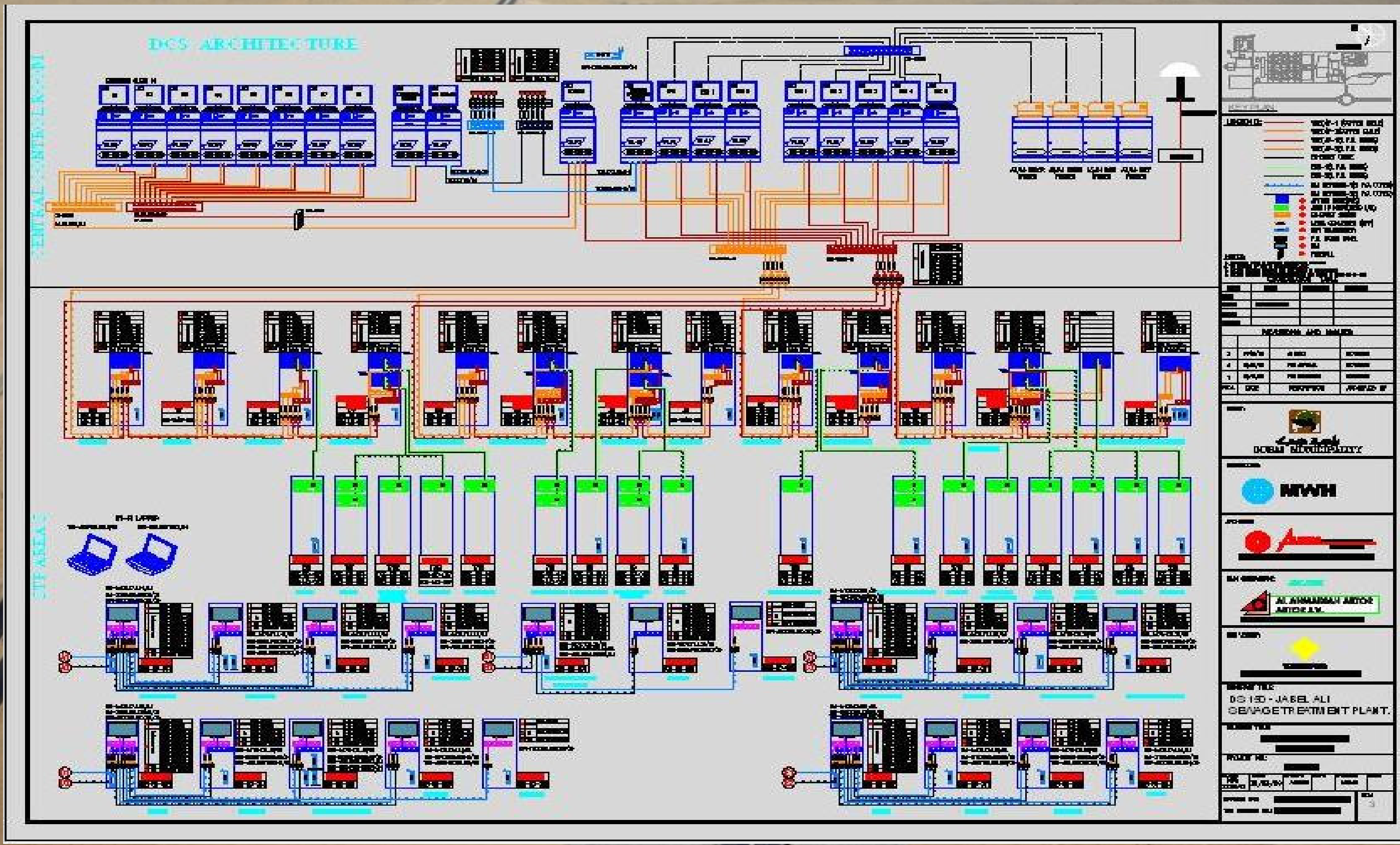
INLET HEAD WORKS

PRE AERATION

ACTIVATED SLUDGE REACTOR


CONTROL SYSTEM

STP CONTROL ARCHITECTURE



SUMMARY OF DCS

- 32 ICA CONTROL PANELS
- 19 YOKOGOWA FIELD CONTROL STATIONS
- 21 YOKOGAWA FIELD CONTROL RIO'S
- 18 HMI (TOUCH PANELS) AROUND THE FIELD
- 160 UNMANGED GIGA BYTE NETWORK SWITCHES
- 90 PROFIBUS NETWORKS BOTH PA AND DP
- 15 VENDORS AUTOMATION FULLY INTEGRATED

DEVICE SUMMARY

- 90 x PROFIBIS PA INSTRUMENTS
- 360 x PROFIBUS DP ACTUATORS
- 260 x PROFIBUS DP MOTOR SOFT STARTERS
- 160 x PROFIBUS DP VFD'S
- 175 x DIRECT ONLINE STARTERS (PROFIBUS DP)
- 6 x 6.6 kv MEDIUM VOLTAGE VFD'S (PROFIBUS DP)
- 65 x 3RD PARTY VENDORS I/O MODULES (DP)
- 15 x S7 PLC SYSTEM WITH DP COMMUNICATION
- 30 x SIMOCODE WITH DP
- 30 x PA/DP COUPLERS

BENEFITS OF PROFIBUS

- One type of “Control System”
- One “Knowledge Package”
- One “Group of Spare Parts”
- One “Design Strategy”

WHY WE CHOOSE PROFIBUS?

- The STP design includes above 30,000 I/O signals at initial stage
- Integrating these signals with conventional hardwired system will consume more cable cost, more installation time, more documentation, increased in panel sizes due to increase in I/O's..etc
- Enhanced diagnostics in each process instruments


TOTAL I/O SIGNALS
3882 x SOFT AI
1235 x SOFT AO
20000 x SOFT DI
2000 x SOFT DO
91 x WIRED AI
10 x WIRED AO
1465 x WIRED DI
635 x WIRED DO
244 x AI MODULES
50 x AO MODULES
560 x DI MODULES
54 x DO MODULES
ELIMINATED DUE TO PROFIBUS
@Shahul, M/S Dubai Municipality

PROFIBUS INTEGRATION

- STP has both Profibus DP and PA networks
- DP networks considered on all Actuators , Motor Starters, power monitors..etc
- PA networks mainly considered on all kind of process instruments
- PA network further classified into “Critical” and “Non-critical” networks
- Critical network designed with redundancy

DEVICE INTEGRATION

- ❖ Maximum devices limited in each network is 30
- ❖ Some areas extended up to 50 with aid of repeaters
- ❖ All PA devices has configured with diagnostic reporting
- ❖ Motor starters and Field Actuators are divided into separate networks

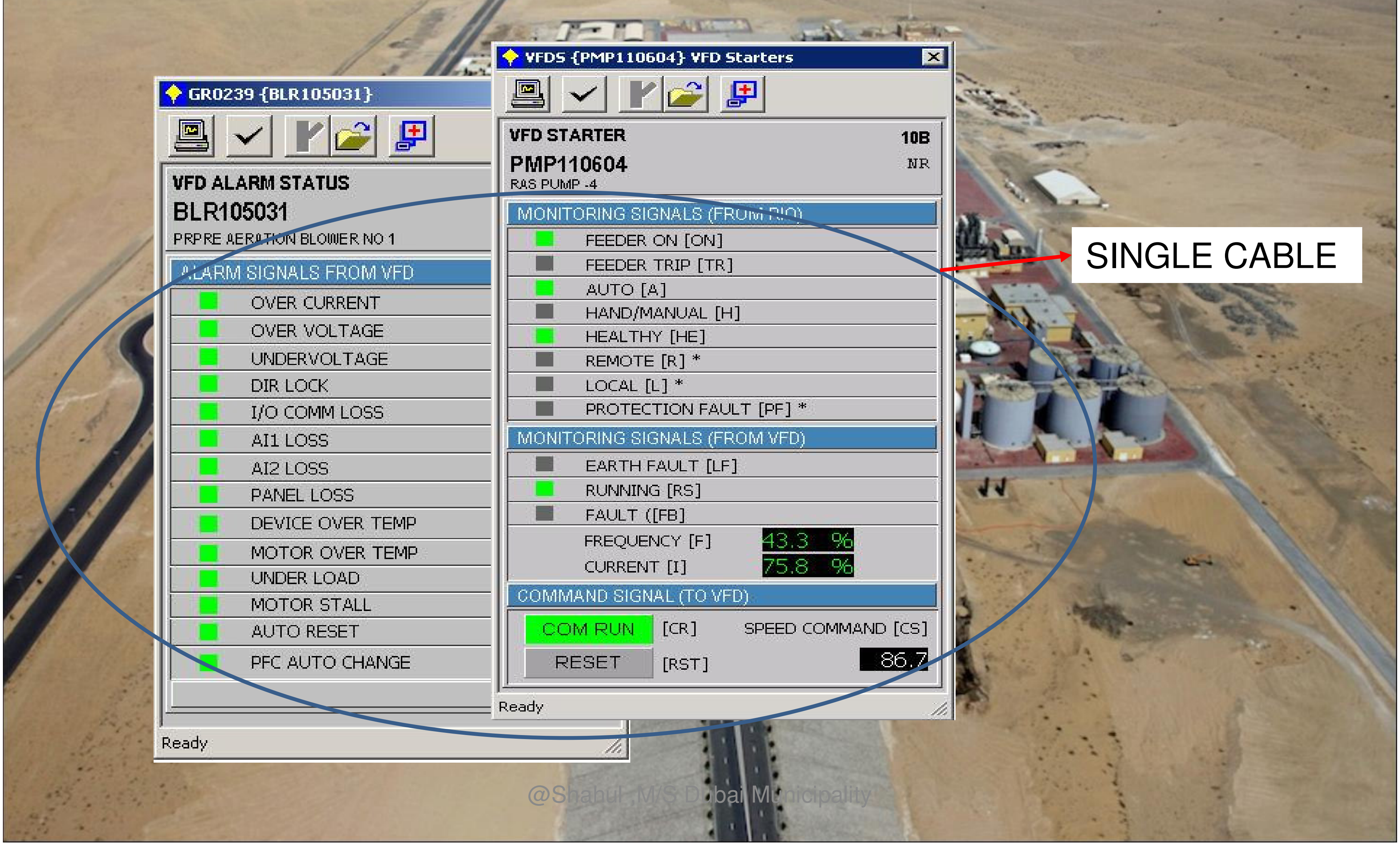
NETWORK SPEEDS AT JASTP

- Profibus DP network has average speed of 187 KBPS and Maximum 1.5 MBPS
- Profibus PA network has fixed speed of 93.75 KBPS with PA/DP coupler
- Network Length divided into 100 meter,500 meter and above 500 meter groups
- Repeaters are used where the network length above 500 meters

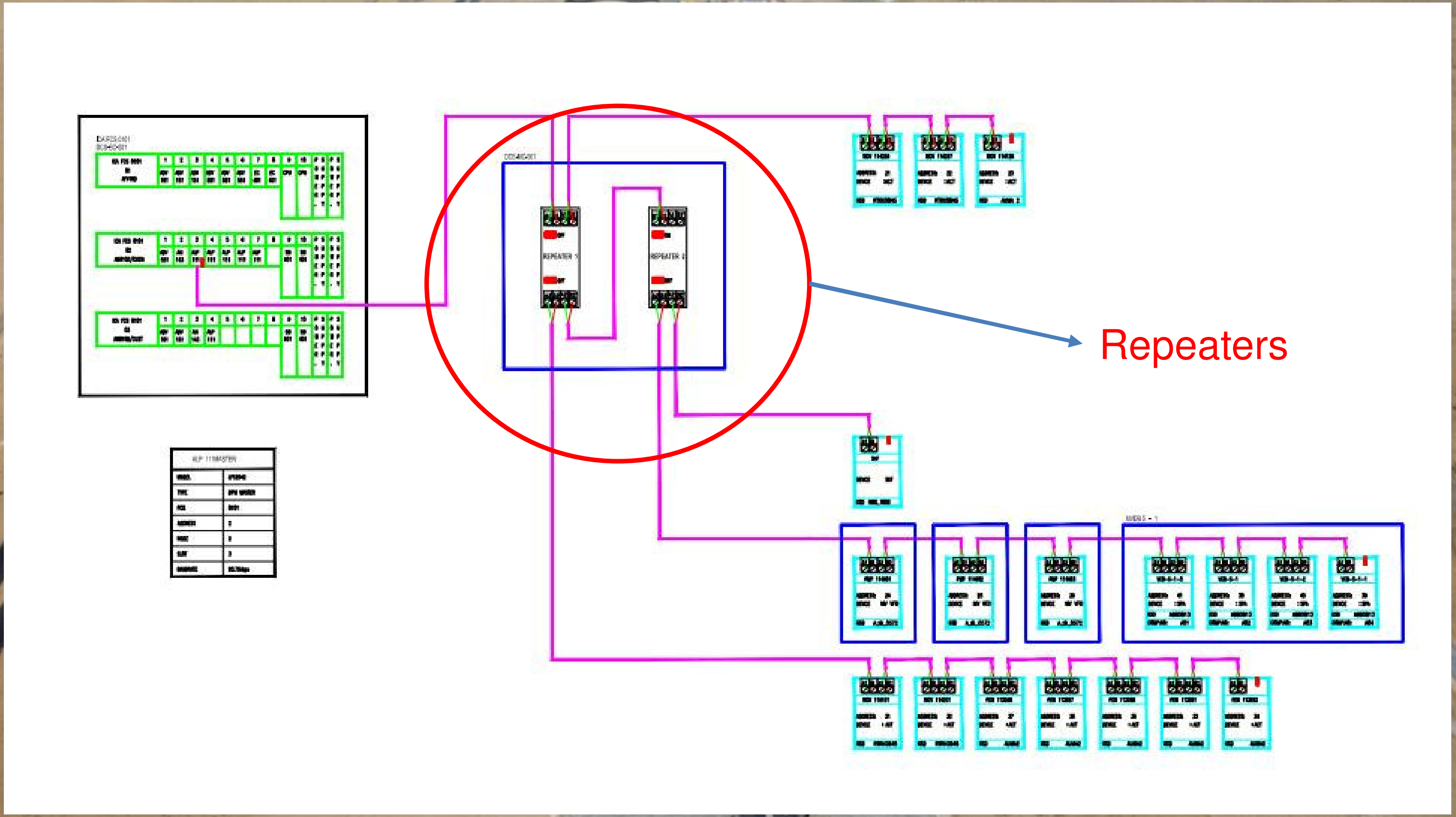
VFD without PROFIBUS

- Initial Scope defined in the VFD 8DI,2DO,2AI,1AO signals only
- Design considered additional 14 AO signals in each VFD
- Total 8DI,16AI,2DO,1AO required 27*2 Core cables/VFD
- Profibus eliminates all the above complication by carrying all signals in a "Single" cable

VFD with PROFIBUS



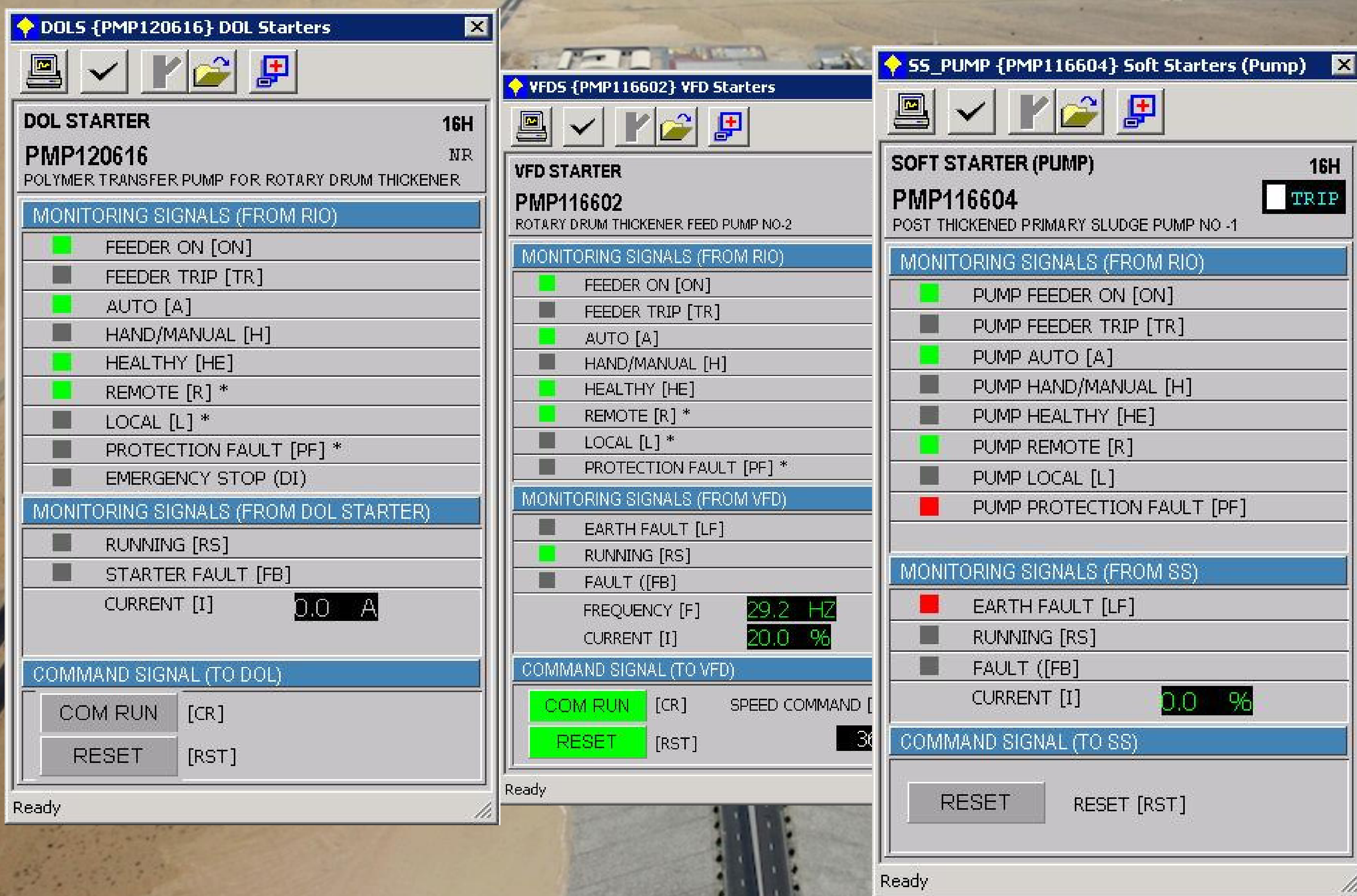
PROFIBUS DP TOPOLOGY



BENEFITS AFTER PROFIBUS

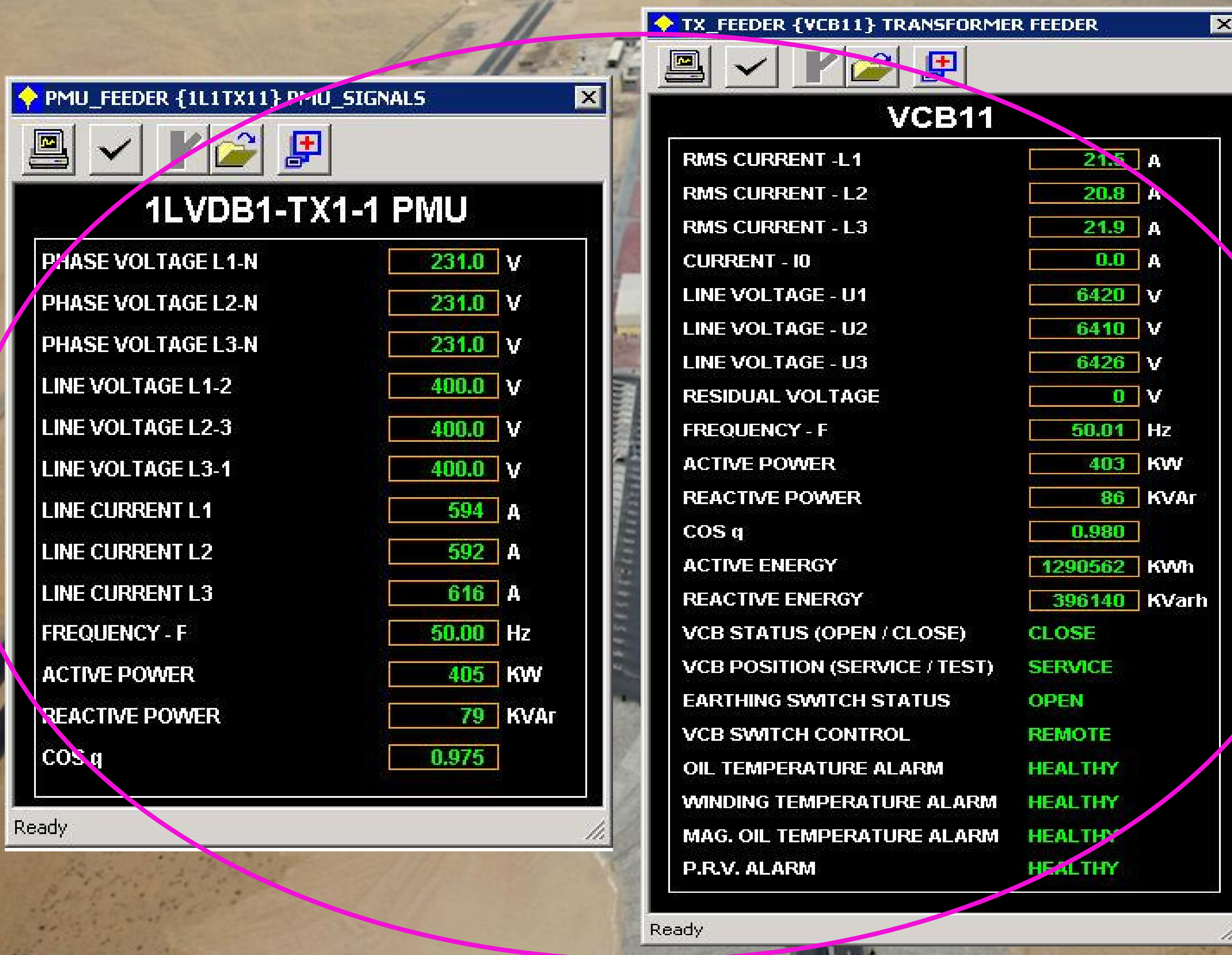
- Reduced installation time
- Less Cost by saving almost above 150 Km of cables and additional I/O modules
- Less documentation
- Easy integration with different vendors
- Quick repair and Commissioning
- Easy integration with PRM Server

SIGNALS PAGE



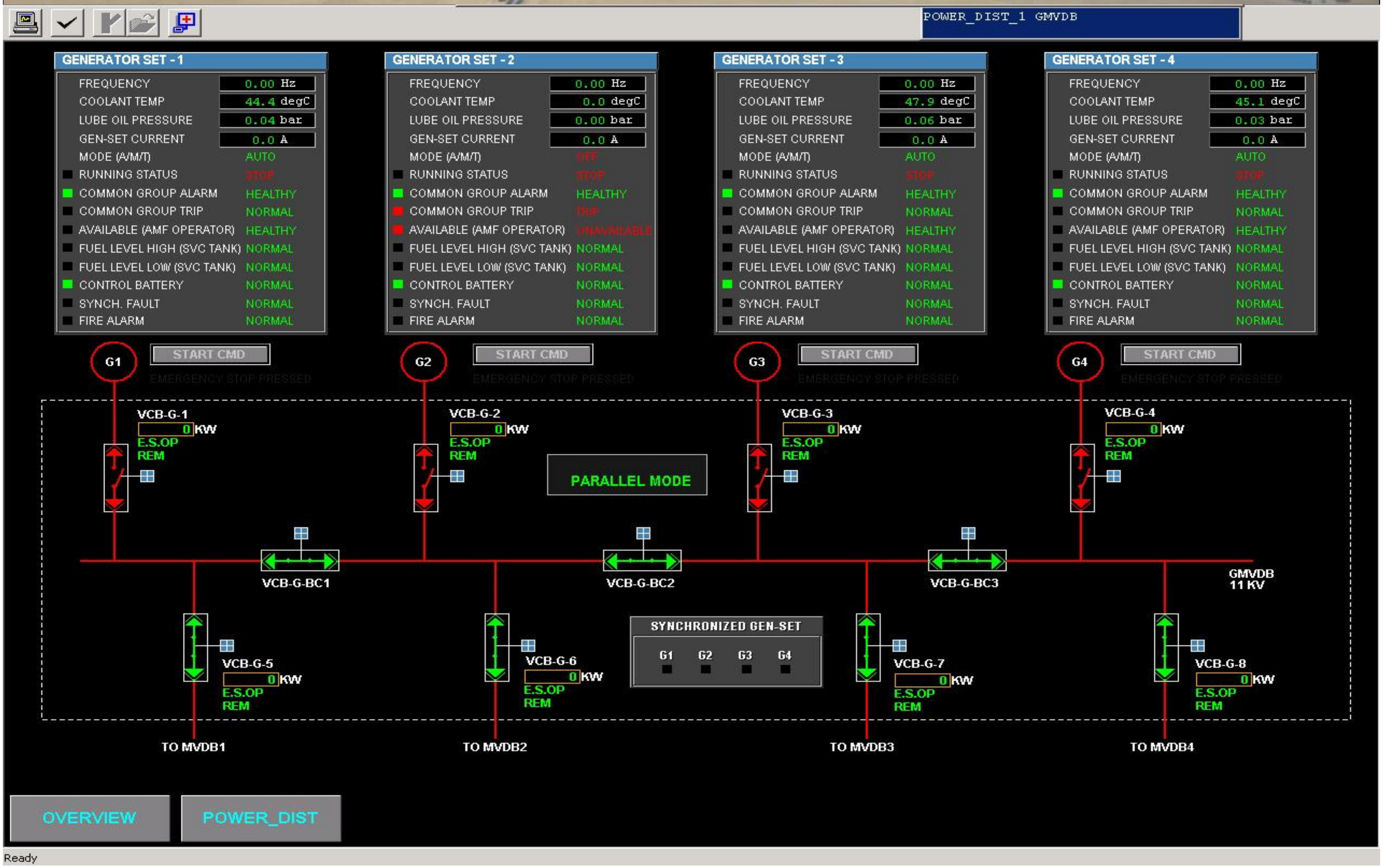

ACTUATOR_MOV2 {MOV116148} Actuators (M...
ACTUATORS (MOV)
16H
MOV116148
NR
RDT FEED PUMP 3 & 4 HEADER MOTORIZED VALV
MONITORING SIGNALS
OPEN LIMIT SW [ZSO]
CLOSE LIMIT SW [ZSC]
GENERAL FAULT [GF]
SWITCH POSITION "REMOTE" [R]
SWITCH POSITION "LOCAL" [L]
TORQUE SWITCH CLOSE [WSH]
LOCAL OPEN [LO]
LOCAL CLOSE [LC]
ACTUAL POSITION [AP] 100.0%
COMMAND SIGNALS
RS DISABLED [RS]
REMOTE SETPOINT [SP]
100.0%
REM CLOSE [RC]
REM OPEN [RO]
Ready
All signals exchanged via PROFIBUS

LV & HV POWER MONITORING

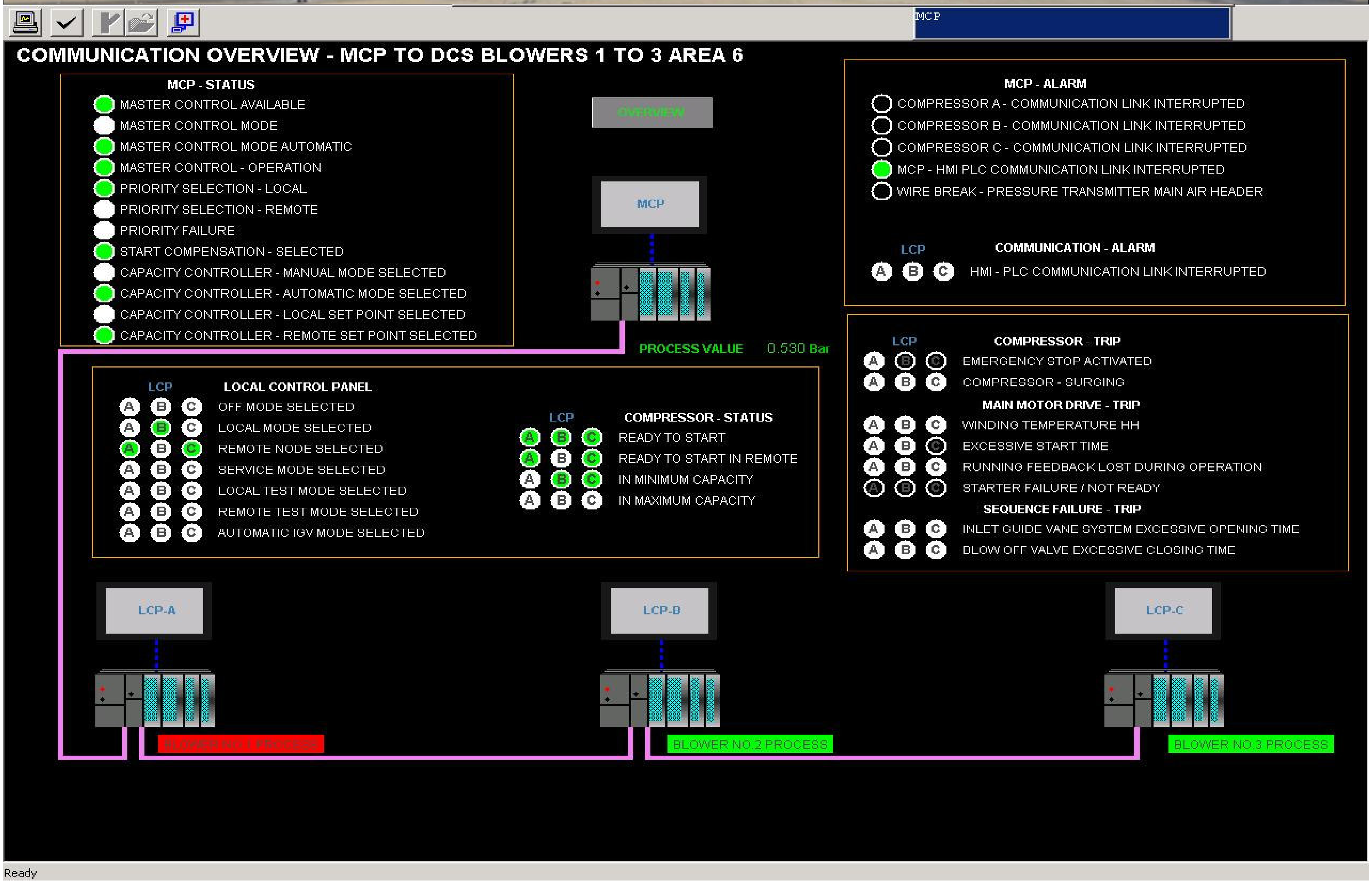


All signals are Analogue via PROFIBUS

GENERATOR CONTROLS



PROFIBUS NETWORK WITH PLC'S



PLANT FLOW TABLE

GR0070

OVERVIEW

PLANT FLOW

14:11:38

LIQUID LINE

DESCRIPTION	CURRENT	TOTALIZER
MAIN INFLUENT	3479.36 M3/H	97781.01 M3
EFFLUENT	7730.83 M3/H	118886.02 M3
DOMESTIC WASTE	1015.75 M3/H	0.00 M3
TRADE WASTE	1832.04 M3/H	0.00 M3
INLET TO PRE AERATION TANK	5033.30 M3/H	108697.57 M3
PST BYPASS FLOW	0.00 M3/H	0.00 M3
INLET TO FILTRATION	8611.90 M3/H	1.10 M3
OUTLET FROM UV	6717.54 M3/H	0.92 M3
SUPERNATANT	815.61 M3/H	9234.15 M3
FOUL BACKWASH WA	737.48 M3/H	1682.41 M3
CLEAN BACKWASH WA	0.00 M3/H	0.00 M3
RE WATER	700.00 M3/H	0.09 M3
POTABLE WATER	7.19 M3/H	0.00 M3

SLUDGE LINE

DESCRIPTION	CURRENT	TOTALIZER
RAS	7623.75 M3/H	0.97 M3
WAS	134.39 L/S	0.02 L
PRIMARY SLUDGE + SCUM FROM PST	0.00 L/S	0.00 L
PRIMARY SLUDGE TO RDT	61.36 L/S	0.00 L
PRIMARY SLUDGE FROM TRADE WASTE TO AREA 18	0.00 L/S	0.00 L
SCUM FROM FST TO RDT/POST THICK TANK	0.00 L/S	0.00 L
THICKENED WAS	0.00 L/S	0.00 L
THICKENED PRIMARY	0.00 L/S	0.00 L
SLUDGE TO DECANTERS	50.16 L/S	0.00 L
DIGESTED SLUDGE	L/S	L

OTHERS

DESCRIPTION	CURRENT	TOTALIZER
POLYMER TO GBT	0.80 L/S	28.23 L
POLYMER TO RDT	1.20 L/S	5.77 L
POLYMER TO DECANTER	2.53 L/S	38.43 L
POLYMER TO FILTERS	0.00 L/S	108553.75 L
FERRIC CHLORIDE TO INLET	4.00 L/S	0.00 L
FERRIC CHLORIDE TO FILTERS	1056.71 L/S	143869.65 L
AIR TO AERATION	51158.06 M3/H	710679.21 M3
AIR TO PRE AERATION	11723.23 L/S	192486.78 L
AIR TO GRIT CHAMBERS	7108.69 M3/H	163435.55 M3
AIR TO FILTERS	******* L/S	51951.77 L
FOUL AIR AT DISCHARGE STACK	*******	2795355.67 M3

DIFFERENCE IN MAIN INFLUENT AND PRE AERATION ******* M3

TOTALIZED VALUES SINCE 14:11:33 0 MIN

RESET TOTALIZER FIG

Ready