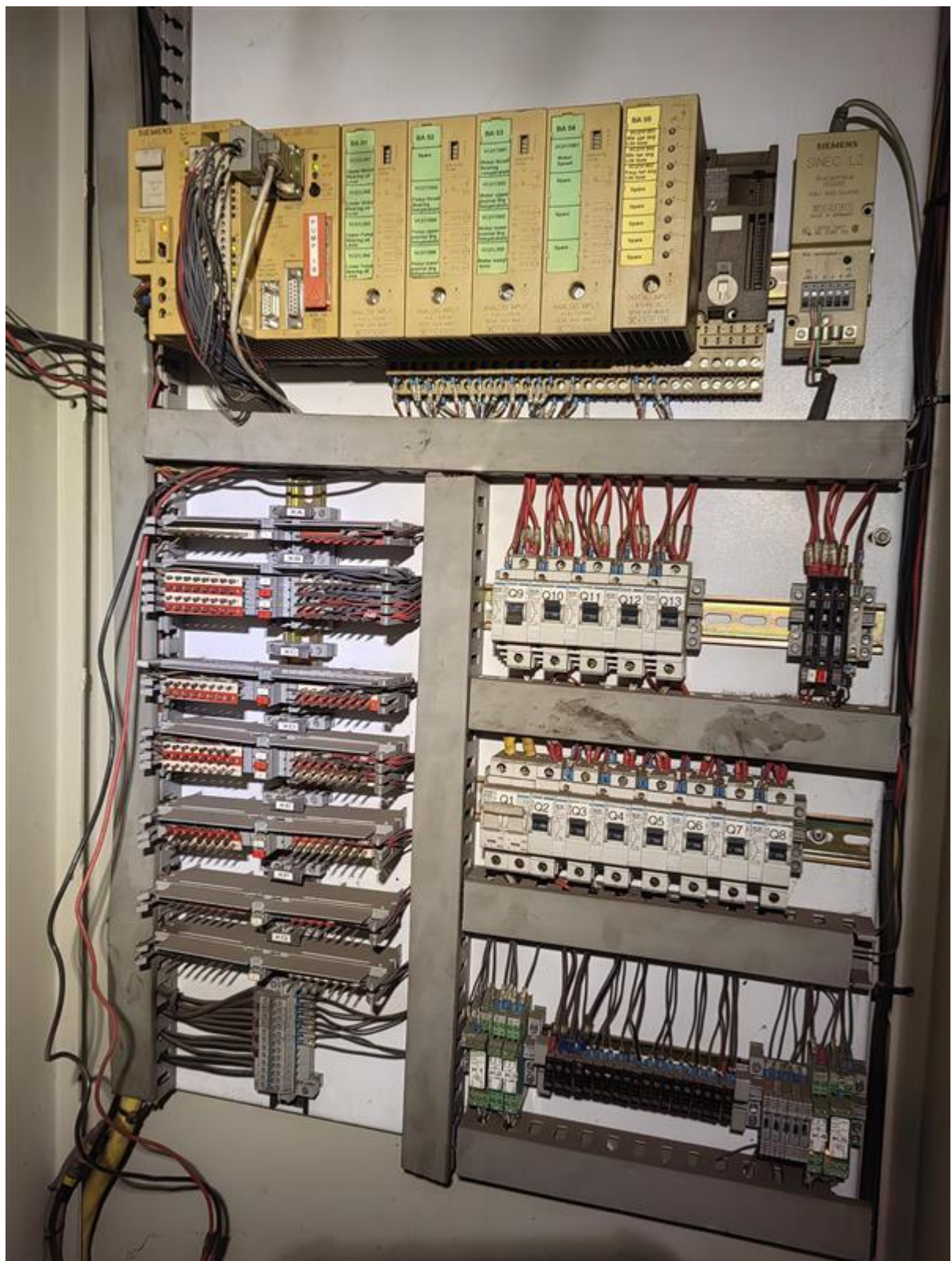


CW Pump PLC Cabinet Overview





Technical
Manual
For
CW pump PLC

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Basic Description:

The PLC consist of a Siemens S5 95U PLC with external analogue input modules. The PLC is connected to a control / Data network called the Sinec L2 bus, which will be referred to as the L2. The L2 connects all the Outside Plant PLC's into a network. The end of the L2 is connected to the Gateway where Visual Automation software marshals all L2 and other data bus's data to the SCADA called FIX DMACS. The SCADA is situated in the Unit control room. From here all main controls to the controlled plants can be initiated.

Controlled systems:

The following areas of plant are controlled -

1 CW pump protections

The PLC provides a signal which indicates pump healthy. This signal will not be present when there is a trip condition. The trip conditions are -

- Bearing oil level low
- Bearing temperature high
- Auto closing valve failed to open
- Back up valve failed to open
- Auto closing valve hydraulic leakage excessive
- Reverse rotation

2 Auto closing valve

This valve will be opened when the pump is started, and closed when the pump is stopped. If, due to hydraulic leaks, the valve closes to the 90% open position, the valve will be re-opened.

3 Back up valve

This valve will be opened when the pump is started, and closed when the pump is stopped.

4 Sump pump

This pump will be started on a high level in the sump, and stopped on a low level.

Plant philosophy.

Starting sequence

The PLC must provide a signal to the control room that the pump is healthy. Then the CW pump can be started from the control room. As soon as the vacuum circuit breaker closes, signals are sent to the two valves to open and to the hydraulic pump to start. Once the CW pump is running, the controls will re-open the auto closing valve as soon as it reaches the 90% open limit.

Shut down sequence

When the CW pump is switched off from the control room, or trips due to a protection, signals are sent to the two valves to close them.

Back up valve

When the CW pump starts, the back up valve receives a signal to open. If the valve does not reach open limit within four minutes of the pump starting, then the pump will be tripped. If while the pump is running, the valve breaks open limit, an alarm will be generated "System fault". When the pump trips or is shut down, the valve receives a signal to close. If the valve does not make closed limit within four minutes, the "System fault" alarm is generated.

Auto closing valve

When the CW pump starts, the auto closing valve receives a signal to open and the hydraulic oil pump a signal to start. If the valve does not reach open limit within four minutes of the pump starting, then the pump will be tripped. If while the pump is running, the valve closes to make the 90% limit, the hydraulic oil pump will be started and the valve opened. If while this is happening, the valve closes to the 85% limit, an alarm will be generated "System fault". If the valve cannot be opened fully within one minute, then the CW pump will be tripped. If the valve cannot be opened fully within three minutes, then the CW pump will be tripped. If the valve makes closed limit, the CW pump will be tripped immediately. When the pump trips or is shut down, the valve receives a signal to close. If the valve does not make closed limit within three minutes, the "System fault" alarm is generated.

Hydraulic oil pump

If there are hydraulic leaks in the system, then the auto closing valve will be closing regularly. This will cause the hydraulic oil pump to start more and more often. A timer will count the number of starts that occur in every hour. If this number is to increase above three starts per hour, then the alarm "System fault" will be generated.

Bearing temperatures

The bearing temperatures are continually monitored, and displayed on the OP25. The alarm limit is also displayed as text on the OP25. If the pump should trip on bearing temperature, the specific bearing that caused the trip will be displayed on the alarm screen of the OP25. Currently the trip value is set for 85 degrees, and the alarm for 75 degrees. If the thermocouple goes open circuit, the trip signal is disabled, and an alarm stating the fault is generated on the OP25.

Bearing oil level

The oil levels are now measured as an analogue value. The values and alarm and trip limits are displayed on the OP25 in the same way as the bearing temperatures. There are different values for each bearing. They are, for the North CW plant -

Bearing	Low level trip	Low level alarm	High level alarm
Motor upper bearing	30mm	40mm	90mm
Motor lower bearing	25mm	35mm	85mm
Pump upper bearing	30mm	40mm	95mm
Pump lower bearing	45mm	55mm	110mm

And for the South CW plant -

Bearing	Low level trip	Low level alarm	High level alarm
Motor upper bearing	10mm	25mm	50mm
Motor lower bearing	95mm	105mm	160mm
Pump upper bearing	25mm	35mm	100mm
Pump lower bearing	115mm	120mm	170mm

If the level transmitter fails and the reading goes to zero, the trip signal will be disabled and the fault alarmed on the OP25.

Reverse rotation

If a reverse rotation is detected while the CW pump is off, the CW pump will be unable to start. If a reverse rotation is detected before either of the valves has opened after starting the CW pump, then the pump will be tripped. Once the CW pump is running and either of the valves has opened, then the reverse rotation detection is ignored.

Sump pump

The level in the sump is measured, and indicated on the OP25. When the level becomes high (200mm), the sump pump will be started, and stopped once the sump level has returned to normal (50mm).

PLC failure mode

If the PLC should go into stop mode for any reason, the CW pump will continue to run, but with no protections. If the CW pump should be stopped, the PLC would be unable to shut the valves. For this reason, a hard-wired connection has been installed to ensure that if the CW pump is switched off, and the PLC is not healthy, the two valves will receive a close command.

Test function

A test function has been incorporated with the OP25. This is a function that is available to maintenance staff, and is only available if the CW pump is not running. This function will allow maintenance staff to open and close both the back up valve and the auto closing valve from the OP25. This function has been interlocked in such a way that a valve cannot be opened on test unless the other valve has a closed limit. If the test function has been used to open the auto closing valve, then the function that counts the number of starts of the hydraulic pump could have been over ranged. This will lead to a permanent alarm. It is recommended that the PLC is switched off and then on again. This will cause the PLC to reload the software from the EPROM, and clear the counter.

Alarm screen

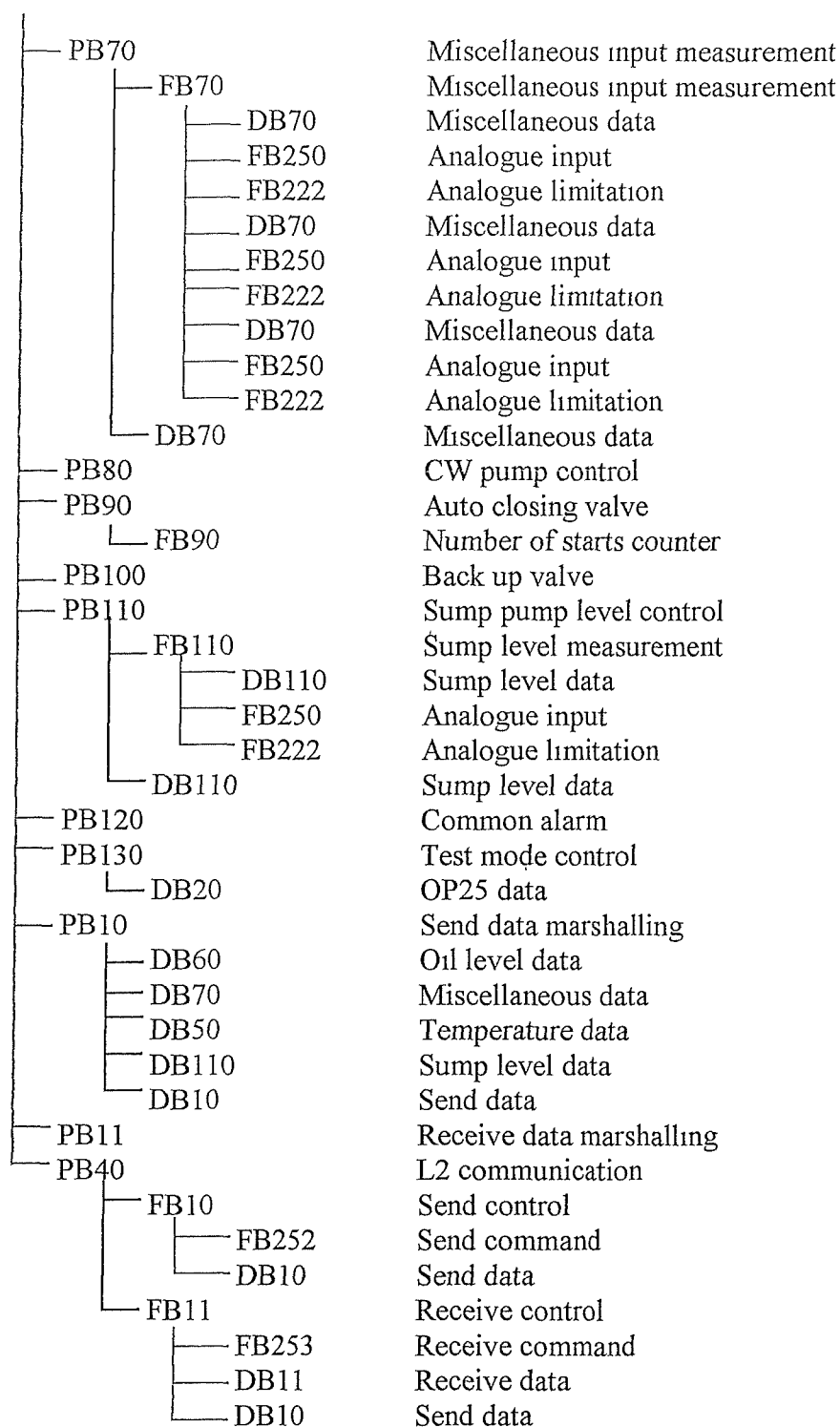
An alarm screen is available on the OP25. This screen is entered into by pressing K5, and can only be exited by pressing the "Esc" button. There are two alarm screens available, which are alternated with pressing K5. The one screen is the standing alarms, which indicates the alarms that are still active. The other screen indicates the alarm history.

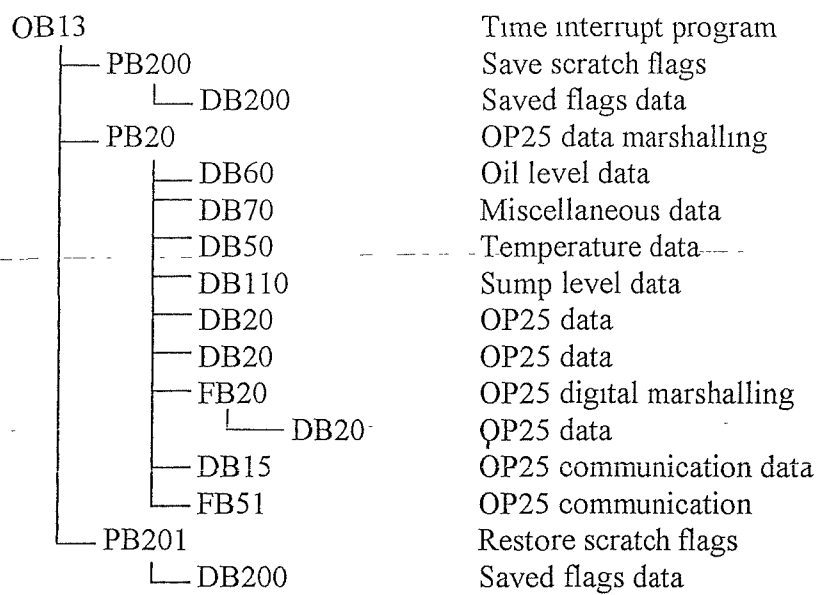
CW flow

The CW flow is measured in different manners at the North and South CW plants. The North plant uses an analogue transmitter on the common CW flow line. The South plant uses flow switches on each of the individual CW flow lines. The low flow alarm is only generated if the pump is in service. This is because the bearing CW flow is generated from the pump discharge.

Control room indications.

The indications that are displayed in the control room are generated from the open and closed limits. This means that when the valve has left open limit due to hydraulic leakages, there is no facial indication of the valve position. Information is relayed to the SCADA, which indicates that the valve has opened, and has not yet reached the 85% limit. This can be used to show the operator that the valve is in its controlled state.





PLC software description.

Software block list

Block no

Block description

- 1 PB1 - OP25 synchronisation
This block sets up the synchronisation between the PLC and the OP after each restart of the PLC
- 2 PB10 - L2 send marshalling

Segment 1	Marshall the analogue data from DB's to DB10.
Segment 2.	Empty
Segment 3	Block end
- 3 PB20 - OP25 data marshalling

Segment 1	Marshall the analogue data from DB's to DB10
Segment 2	Marshall digital alarm and trip bits
Segment 3	Calls FB20
Segment 4	Calls FB51
- 4 PB40 - L2 communication

Segment 1.	Call FB10 and FB11 and links loop back word
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- 5 PB50 - Temperature measurement

Segment 1	Calls FB50
Segment 2	Generates alarm and trip bits for pump thrust bearing
Segment 3	Generates alarm and trip bits for pump upper journal bearing
Segment 4	Generates alarm and trip bits for pump lower journal bearing
Segment 5	Generates alarm and trip bits for motor thrust bearing
Segment 6	Generates alarm and trip bits for motor upper journal bearing
Segment 7	Generates alarm and trip bits for motor lower journal bearing
- 6 PB60 - Oil level measurement

Segment 1	Calls FB60
Segment 2	Generates alarm and trip bits for motor upper bearing
Segment 3	Generates alarm and trip bits for motor lower bearing
Segment 4	Generates alarm and trip bits for pump upper bearing
Segment 5	Generates alarm and trip bits for pump lower bearing
- 7 PB70 - Miscellaneous input measurement

Segment 1	Calls FB70
Segment 2	Generates alarm bit for CW flow
- 8 PB80 - CW pump control

Segment 1	Provides a pump healthy signal dependant on protections
Segment 2	Block end

9 PB90 - Auto closing valve

- Segment 1 Generates the open valve command
- Segment 2 Generates the failed to open pump protection
- Segment 3 Generates the valve alarm bits
- Segment 4 Generates the hydraulic leak pump protection
- Segment 5 Generates the close valve command
- Segment 6 Calls FB90
- Segment 7 Generates signals for between limit indication
- Segment 8 Block end

10 PB100 - Back up valve

- Segment 1 Generates the open valve command
- Segment 2 Generates the failed to open pump protection
- Segment 3 Generates the valve alarm bits
- Segment 4 Generates the close valve command

11 PB110 - Sump pump

- Segment 1 Calls FB110
- Segment 2 Generates the control and alarm bits
- Segment 3 Starts and stops the sump pump

12 PB120 - Pump alarms

- Segment 1 Generates the alarm output
- Segment 2 Block end

13 PB130 - Test mode

- Segment 1 Reads the test mode bits from the OP25
- Segment 2 Generates the test mode instructions

14 PB200 - Save scratch flags

- Segment 1 Saves all scratch flags to DB200

15 PB201 - Restore scratch flags

- Segment 1 Restores the scratch flags from DB200

16 FB10 - Send control

- Segment 1 Calls FB252
- Segment 2 Marshall digital data into DB10
- Segment 3 Marshall digital data into DB10
- Segment 4 Block end

17 FB11 - Receive control

- Segment 1 Calls FB253

18 FB20 - OP25 Digital data

Segment 1	Saves an input into a word address
Segment 2	Saves an input into a word address
Segment 3	Saves an input into a word address
Segment 4	Saves an input into a word address
Segment 5	Saves an input into a word address
Segment 6	Saves an input into a word address
Segment 7	Saves an input into a word address
Segment 8	Saves an input into a word address
Segment 9	Saves an input into a word address
Segment 10	Saves an input into a word address
Segment 11	Saves an input into a word address
Segment 12	Saves an input into a word address
Segment 13	Saves an input into a word address
Segment 14	Saves an input into a word address
Segment 15	Saves an output into a word address
Segment 16	Saves an output into a word address
Segment 17	Saves an output into a word address
Segment 18	Saves an output into a word address
Segment 19	Saves an output into a word address
Segment 20	Saves an output into a word address
Segment 21	Saves an output into a word address
Segment 22	Saves an output into a word address
Segment 23	Saves an output into a word address
Segment 24	Saves an output into a word address
Segment 25	Saves an output into a word address
Segment 26	Saves an output into a word address
Segment 27	Block end

19 FB50 - Temperature input

Segment 1	Reads and limits the input for pump thrust bearing
Segment 2	Reads and limits the input for pump upper journal bearing
Segment 3	Reads and limits the input for pump lower journal bearing
Segment 4	Reads and limits the input for motor thrust bearing
Segment 5	Reads and limits the input for motor upper journal bearing
Segment 6	Reads and limits the input for motor lower journal bearing

20 FB51 - OP25 communication

This is a Siemens propriety block, and more information on this block can be found in the Siemens manuals

21 FB60 - Oil level input

Segment 1	Reads and limits the input for motor upper bearing
Segment 2	Reads and limits the input for motor lower bearing
Segment 3	Reads and limits the input for pump upper bearing
Segment 4	Reads and limits the input for pump lower bearing

22 FB70 - Miscellaneous inputs

- Segment 1 Reads and limits the input for bearing cooling water flow
- Segment 2 Reads and limits the input for motor current
- Segment 3 Reads and limits the input for motor speed

23 FB90 - Number of starts counter

- Segment 1 Sets bit to start timers
- Segment 2 Starts first one hour timer
- Segment 3 Starts second one hour timer
- Segment 4 Starts third one hour timer
- Segment 5 Starts fourth one hour timer
- Segment 6 Starts fifth one hour timer
- Segment 7 Starts sixth one hour timer
- Segment 8 Starts seventh one hour timer
- Segment 9 Starts eighth one hour timer
- Segment 10 Counts the first two timers if running
- Segment 11 Counts the second two timers if running
- Segment 12 Counts the third two timers if running
- Segment 13 Counts the fourth two timers if running
- Segment 14 Compares the number of running timers to the alarm limit
- Segment 15 Resets timer start bits

24 FB110 - Sump level measurement

- Segment 1 Reads and limits the input for the water sump level

25 FB222 - Analogue limitation

- Segment 1 Limits the input to the values given to it

26 FB223 - Analogue limitation

- Segment 1 Limits the input to the values given to it

27 FB250 - Analogue input

This is a Siemens propriety block, and more information on this block can be found in the Siemens manuals

28 FB252 - L2 sent control

This is a Siemens propriety block, and more information on this block can be found in the Siemens manuals

29 FB253 - L2 receive control

This is a Siemens propriety block, and more information on this block can be found in the Siemens manuals

30 OB1 - Cyclic program

- Segment 1 Calls all the PB's that are run cyclically
- Segment 2 Block end

31 OB13 - Time interrupt program

- Segment 1 Calls the programs needed for the OP25

32 DB1 - CMOS set-up

This can be seen as the PLC's CMOS set-up. In this block a lot of parameters are set as required for each PLC's configuration. The detail meaning of each parameter can be found in the PLC manual.

33 DB10 - Send data

DW 2 0	CW pump VCB closed
DW 2 1	CW pump VCB open
DW 2 2	ACV 100% open position
DW 2 3	ACV 90% open position
DW 2 4	ACV 85% open position
DW 2 5	ACV closed limit
DW 2 6	ACV hydraulic pump motor tripped
DW 2 7	ACV hydraulic oil level low
DW 2 8	Back-up v/v switch-gear fault
DW 2 9	Back-up v/v open limit
DW 2 10	Back-up v/v closed limit
DW 2 11	Back-up v/v open torque limit
DW 2 12	Back-up v/v closed torque limit
DW 2 13	Battery charger common alarm
DW 2 14	Sump pump motor on
DW 2 15	MCB tripped
DW 3 0	CW pump reverse rotation detected
DW 3 1	Trip CW pump
DW 3 2	Close back-up v/v
DW 3 3	Open back-up v/v
DW 3 4	Start ACV hydraulic pump
DW 3 5	Open ACV (Close solenoid drain v/v)
DW 3 6	Close ACV (Open solenoid drain v/v)
DW 3 7	Start sump pump
DW 3 8	Stop sump pump
DW 3 9	CW pump 6A system fault
DW 3 10	PLC healthy
DW 0	Loop back word
DW 20	Upper motor bearing oil level
DW 21	Lower motor bearing oil level
DW 22	Upper pump bearing oil level
DW 23	Lower pump bearing oil level
DW 24	Motor bearing CW flow
DW 25	Pump thrust bearing temp
DW 26	Pump upper journal bearing temp
DW 27	Pump lower journal bearing temp
DW 28	Motor thrust bearing temp
DW 29	Motor upper journal bearing temp
DW 30	Motor lower journal bearing temp
DW 31	Water sump level
DW 32	CW pump motor current
DW 33	CW pump motor speed
DW 34	Number of ACV pump starts/hr

34 DB11 - Recerve data

DW 0 Loop back word

35 DB15 - OP25 communication

This data block is used by the OP25 communication function block to establish and maintain communication between the OP25 and the PLC - -

36 DB20 - OP25 data

DW 10 Upper motor bearing oil level
 DW 11 Lower motor bearing oil level
 DW 12 Upper pump bearing oil level
 DW 13 Lower pump bearing oil level
 DW 14 Motor bearing CW flow
 DW 15 Pump thrust bearing temp
 DW 16 Pump upper journal bearing temp
 DW 17 Pump lower journal bearing temp
 DW 18 Motor thrust bearing temp
 DW 19 Motor upper journal bearing temp
 DW 20 Motor lower journal bearing temp
 DW 21 Water sump level
 DW 22 CW pump motor current
 DW 23 CW pump motor speed
 DW 24 ACV hydraulic pump starts/hr
 DW 30 1 Pump thrust bearing temp alarm
 DW 30 2 Pump upper journal bearing temp alarm
 DW 30 3 Pump lower journal bearing temp alarm
 DW 30 4 Motor thrust bearing temp alarm
 DW 30 5 Motor upper journal bearing temp alarm
 DW 30 6 Motor lower journal bearing temp alarm
 DW 31 1 Pump thrust bearing temp trip
 DW 31 2 Pump upper journal bearing temp trip
 DW 31 3 Pump lower journal bearing temp trip
 DW 31 4 Motor thrust bearing temp trip
 DW 31 5 Motor upper journal bearing temp trip
 DW 31 6 Motor lower journal bearing temp trip
 DW 32 1 Upper motor bearing oil level high alarm
 DW 32 2 Lower motor bearing oil level high alarm
 DW 32 3 Upper pump bearing oil level high alarm
 DW 32 4 Lower pump bearing oil level high alarm
 DW 33 1 Upper motor bearing oil level low alarm
 DW 33 2 Lower motor bearing oil level low alarm
 DW 33 3 Upper pump bearing oil level low alarm
 DW 33 4 Lower pump bearing oil level low alarm
 DW 34 1 Upper motor bearing oil level low trip
 DW 34 2 Lower motor bearing oil level low trip
 DW 34 3 Upper pump bearing oil level low trip
 DW 34 4 Lower pump bearing oil level low trip
 DW 40 CW pump VCB Closed
 DW 41 CW pump VCB Open

DW 42	ACV 100% open position
DW 43	ACV 90% open position
DW 44	ACV 85% open position
DW 45	ACV closed limit
DW 46	ACV hydraulic pump motor tripped
DW 47	ACV hydraulic oil level low
DW 48	Back-up v/v switch-gear fault
DW 49	Back-up v/v open limit
DW 50	Back-up v/v closed limit
DW 51	Back-up v/v open torque limit
DW 52	Back-up v/v closed torque limit
DW 53	Battery charger common alarm
DW 54	Sump pump motor on
DW 55	MCB tripped
DW 56	CW pump reverse rotation detected
DW 57	Trip CW pump
DW 58	Close back-up v/v
DW 59	Open back-up v/v
DW 60	Start ACV hydraulic pump
DW 61	Open ACV (Close solenoid drain v/v)
DW 62	Close ACV (Open solenoid drain v/v)
DW 63	Start sump pump
DW 64	Stop sump pump
DW 65	CW pump 6A system fault
DW 66	PLC healthy
DW 72	Test mode
DW 73	Back up valve open/close
DW 74	Auto closing valve open/close

37 DB50 - Temperature data

DW 1	Pump thrust bearing temperature
DW 2	Pump upper journal bearing temperature
DW 3	Pump lower journal bearing temperature
DW 4	Motor thrust bearing temperature
DW 5	Motor upper journal bearing temperature
DW 6	Motor lower journal bearing temperature

38 DB60 - Oil level data

DW 1	Motor upper bearing oil level
DW 2	Motor lower bearing oil level
DW 3	Pump upper bearing oil level
DW 4	Pump lower bearing oil level

39 DB70 - Miscellaneous data

DW 1	Motor bearing cooling water flow
DW 2	CW pump motor current
DW 3	CW pump motor speed

40 DB110 - Sump level data
DW 1 Sump level

41 DB200 - Scratch flag data
This data block is used to store the scratch flags that are in use while the time interrupt OB is being run. This ensures that no data is altered while OB13 is being executed.

Communication information.

Due to all the CW pumps being connected to the same L2 bus, the information in the “Address”, “Node” and “SSAP” columns differs for each pump. This is a table of the difference between the pumps

Pump	Digital address	Analogue address	Node	SSAP
1A	D2800	A1400	10	11
1B	D3000	A1500	11	12
2A	D3200	A1600	12	13
2B	D3400	A1700	13	14
3A	D3600	A1800	14	15
3B	D3800	A1900	15	16
4A	D4200	A2100	24	25
4B	D4400	A2200	23	24
5A	D4600	A2300	26	27
5B	D4800	A2400	25	26
6A	D5000	A2500	28	29
6B	D5200	A2600	27	28

Address	Alpha No	Description	Data block	Node	SSAP	DSAP	DW	Bit
D		CW pump VCB closed	I 32.0			32	2	0
D		CW pump VCB open	I 32 1			32	2	1
D		ACV 100% open position	I 32 2			32	2	2
D		ACV 90% open position	I 32 3			32	2	3
D		ACV 85% open position	I 32 4			32	2	4
D		ACV closed limit	I 33 2			32	2	5
D		ACV hydraulic pump motor tripped	I 32 5			32	2	6
D		ACV hydraulic oil level low	I 32 6			32	2	7

Address	Alpha No	Description	Data block	Node	SSAP	DSAP	DW	Bit
D		Back-up v/v switch-gear fault	I 32 7			32	2	8
D		Back-up v/v open limit	I 33 0			32	2	9
D		Back-up v/v closed limit	I 33 1			32	2	10
D		Back-up v/v open torque limit	Not used			32	2	11
D		Back-up v/v closed torque limit	Not used			32	2	12
D		Battery charger common alarm	I 33 4			32	2	13
D		Sump pump motor on	I 33 5			32	2	14
D		MCB tripped	I 33 6			32	2	15
D		CW pump reverse rotation detected	I 33 7			32	3	0
D		Trip CW pump	Q 32 0			32	3	1
D		Close back-up v/v	Q 32 1			32	3	2
D		Open back-up v/v	Q 32 2			32	3	3
D		Start ACV hydraulic pump	Not used			32	3	4
D		Open ACV (Close solenoid drain v/v)	Q 32 4			32	3	5
D		Close ACV (Open solenoid drain v/v)	Q 32 5			32	3	6
D		Start sump pump	Q 32 6			32	3	7
D		Stop sump pump	Not used			32	3	8
D		CW pump 6A system fault	Q 33.1			32	3	9
D		PLC healthy	Q 33 0			32	3	10
D		Valve between 85 and 100%	F 5 1			32	3	11
D		Valve between 0 and 90%	F 5 2			32	3	12
D		Motor upper bearing CW flow (South)	DB70 DBB0			32	3	13
D		Motor lower bearing CW flow (South)	DB70 DBB1			32	3	14
D		Pump lower bearing CW flow (South)	DB70 DBB2			32	3	15
D		CW 1A pmp thrust brg temp trip				32	4	1
D		CW 1A pmp upper brg temp trip				32	4	2
D		CW 1A pmp lower brg temp trip				32	4	3
D		CW 1A mtr thrust brg temp trip				32	4	4

Address	Alpha No	Description	Data block	Node	SSAP	DSAP	DW	Bit
D		CW 1A mtr upper brg temp trip				32	4	5
D		CW 1A mtr lower brg temp trip				32	4	6
D		CW 1A pmp thrust brg temp alarm				32	4	9
D		CW 1A pmp upper brg temp alarm				32	4	10
D		CW 1A pmp lower brg temp alarm				32	4	11
D		CW 1A mtr thrust brg temp alarm				32	4	12
D		CW 1A mtr upper brg temp alarm				32	4	13
D		CW 1A mtr lower brg temp alarm				32	4	14
D		CW 1A mtr upper brg wire break				32	5	0
D		CW 1A mtr upper brg over range				32	5	1
D		CW 1A mtr lower brg wire break				32	5	2
D		CW 1A mtr lower brg over range				32	5	3
D		CW 1A pmp thrust brg wire break				32	5	8
D		CW 1A pmp thrust brg over range				32	5	9
D		CW 1A pmp upper brg wire break				32	5	10
D		CW 1A pmp upper brg over range				32	5	11
D		CW 1A pmp lower brg wire break				32	5	12
D		CW 1A pmp lower brg over range				32	5	13
D		CW 1A mtr thrust brg wire break				32	5	14
D		CW 1A mtr thrust brg over range				32	5	15
D		CW 1A mtr upper oil level low				32	6	1
D		CW 1A mtr lower oil level low				32	6	2
D		CW 1A pmp upper oil level low				32	6	3
D		CW 1A pmp lower oil level low				32	6	4
D		CW 1A mtr upper oil level high				32	6	9
D		CW 1A mtr lower oil level high				32	6	10
D		CW 1A pmp upper oil level high				32	6	11
D		CW 1A pmp lower oil level high				32	6	12

Address	Alpha No	Description	Data block	Node	SSAP	DSAP	DW	Bit
D		CW 1A mtr upper oil level trip				32	7	1
D		CW 1A mtr lower oil level trip				32	7	2
D		CW 1A pmp upper oil level trip				32	7	3
D		CW 1A pmp lower oil level trip				32	7	4
D		CW 1A mtr upper oil level wire break				32	8	0
D		CW 1A mtr upper oil level over range				32	8	1
D		CW 1A mtr lower oil level wire break				32	8	2
D		CW 1A mtr lower oil level over range				32	8	3
D		CW 1A pmp upper oil level wire break				32	8	4
D		CW 1A pmp upper oil level over range				32	8	5
D		CW 1A pmp lower oil level wire break				32	8	6
D		CW 1A pmp lower oil level over range				32	8	7
D		CW 1A CW flow wire break				32	9	0
D		CW 1A CW flow over range				32	9	1
D		CW 1A mtr current wire break				32	9	2
D		CW 1A mtr current over range				32	9	3
D		CW 1A pmp speed wire break				32	9	4
D		CW 1A pmp speed over range				32	9	5
D		CW 1A CW flow low ✓				32	9	7
A	20VC25L501	Upper motor bearing oil level	DB60 DBW1			32	20	
A	20VC25L502	Lower motor bearing oil level	DB60 DBW2			32	21	
A	20VC25L503	Upper pump bearing oil level	DB60 DBW3			32	22	
A	20VC25L504	Lower pump bearing oil level	DB60 DBW4			32	23	
A	20VC25F301	Motor bearing CW flow (North)	DB70 DBW1			32	24	
A	20VC25T004	Pump thrust bearing temp	DB50 DBW1			32	25	
A	20VC25T002	Pump upper journal bearing temp	DB50 DBW2			32	26	
A	20VC25T006	Pump lower journal bearing temp	DB50 DBW3			32	27	
A	20VC25T001	Motor thrust bearing temp	DB50 DBW4			32	28	

Address	Alpha No	Description	Data block	Node	SSAP	DSAP	DW	Bit
A	20VC25T007	Motor upper journal bearing temp	DB50 DBW5			32	29	
A	20VC25T008	Motor lower journal bearing temp	DB50 DBW6			32	30	
A	20VC25L305	Water sump level	DB110 DBW1			32	31	
A	20VC25E001	CW pump motor current	DB70 DBW2			32	32	
A	20VC25V001	CW pump motor speed	DB70 DBW3			32	33	
A	20VC25STRTS	Number of ACV pump starts/hr	C2			32	34	

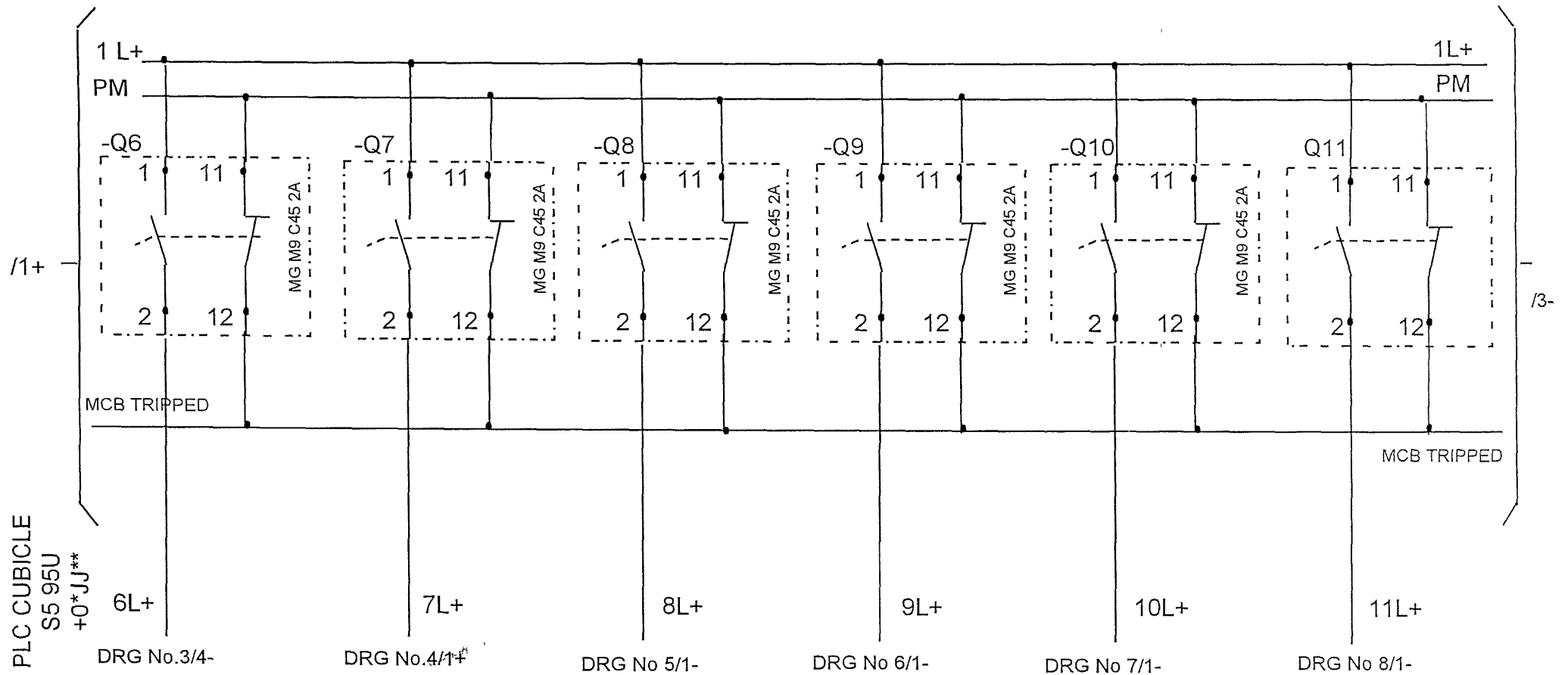
CW North

Index:

- I/O Reference list
- PLC Connection drawings
- Module layout
- Cable layout
- Harting plug & splitter box connection schedule
- PLC Power Supply
- KV 11 Connection Schedule
- LCP Connection Schedule for A Pumps
- LCP Connection Schedule for B Pumps
- PLC Connection schedules
- Commissioning Procedure
- Bill of Material
- OP25 to PLC cable connections
- OP25 to Programming Unit cable connections
- Sump Pump Key cabling diagram
- Auto Closing Valve Key cabling diagram
- Main Breaker Interface cable diagram
- Milltronic calibration Procedure

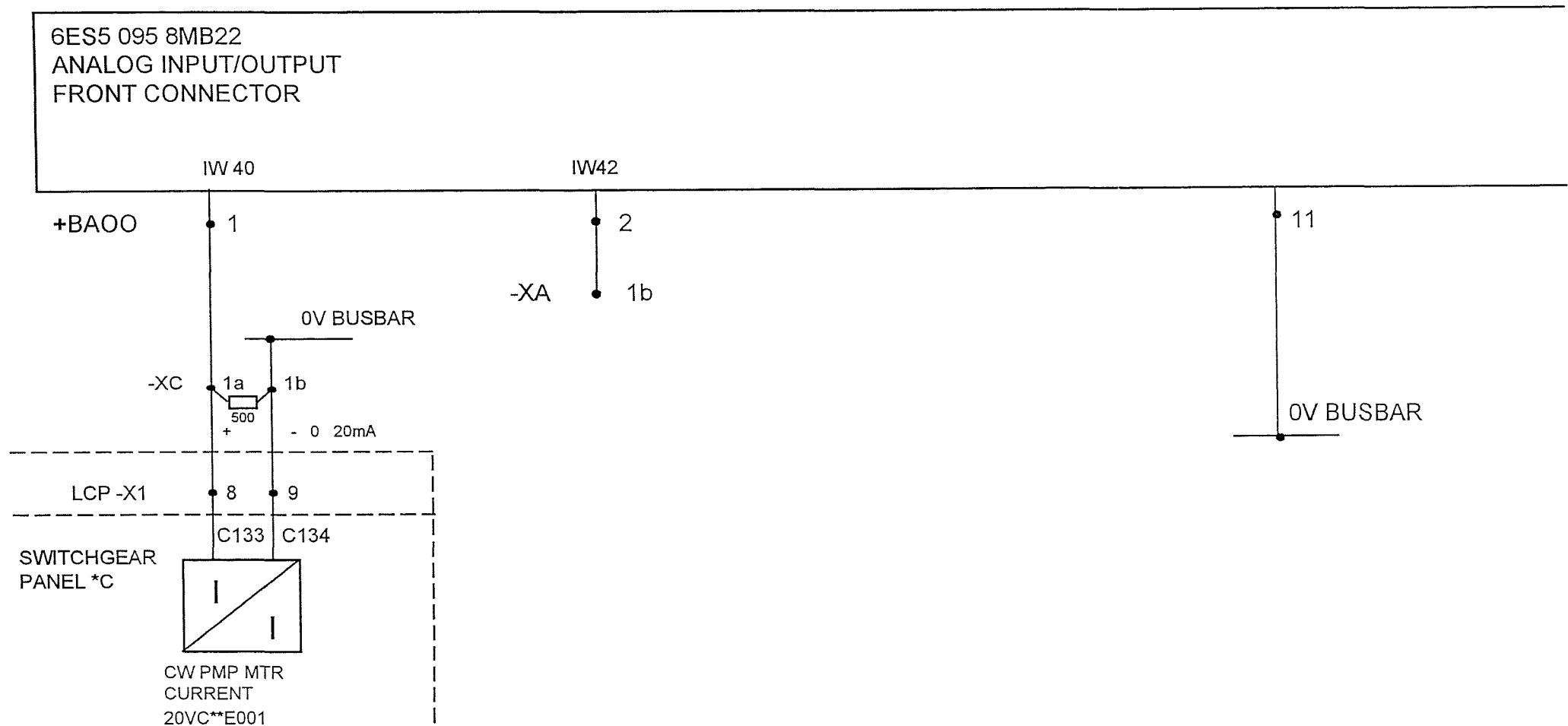
North CW I/O list					
Analog Inputs					
			PLC	SAE	
IW 40	Motor current		BA00 - pin 1		
IW 64	Upper motor bearing oil level	20VC25L501	BA01 3+ 4-	XB 1a +	XB 1b -
IW 66	Lower motor bearing oil level	20VC25L502	BA01 5+ 6-	XB 1c +	XB 1d -
IW 68	Upper pump bearing oil level	20VC25L503	BA01 7+ 8-	XB 1e +	XB 1f -
IW 70	Lower pump bearing oil level	20VC25L504	BA01 9+ 10-	XB 1g +	XB 1h -
IW 72	Motor bearing cooling water flow	20VC25F301	BA02 4+	XB 2a +	XB 2b 0V
IW 74	Pump thrust bearing temp	20VC25T004	BA02 5+ 6-	XB 2c +	XB 2d -
IW 76	Pump upper journal bearing temp	20VC25T005	BA02 7+ 8-	XB 2e +	XB 2f -
IW 78	Pump lower journal bearing temp	20VC25T006	BA02 9+ 10-	XB 2g +	XB 2h -
IW 80	Motor thrust bearing temp	20VC25T001	BA03 3+ 4-	XB 3a +	XB 3b -
IW 82	Motor upper journal bearing temp	20VC25T002	BA03 5+ 6-	XB 3c +	XB 3d -
IW 84	Motor lower journal bearing temp	20VC25T003	BA03 7+ 8-	XB 3e +	XB 3f -
IW 86	Water sump level	20VC25L305	BA03 10+	XB 3g +	XB 3h -
IW 88	Pump motor speed	20VC25Y001	BA04 4+		
IW 90	Spare		BA04 5+ 6-		
IW 92	Spare		BA04 7+ 8-		
IW 94	Spare		BA04 9+ 10-		
Digital Input					
I 32 0	CW Pump VCB CLOSED		BA00 - b2	XC 1d	
I 32 1	CW Pump VCB OPEN		BA00 - b3	XC 1e	
I 32.2	ACV 100%		BA00 - b4	XD 1b	
I 32 3	ACV 90%		BA00 - b5	XD 1c	
I 32 4	ACV 85%		BA00 - b6	XD 1d	
I 32.5	ACV Motor tripped		BA00 - b7	XD 1f	
I 32 6	ACV Hydraulic oil level low		BA00 - b8	XD 3b	
I 32.7	Back up valve switch gear fault		BA00 - b9	XE 1b	
I 33 0	Back up valve OPEN		BA00 - b12	XE 1d	
I 33 1	Back up valve CLOSED		BA00 - b13	XE 1e	
I 33.2	ACV CLOSED		BA00 - b14	XD 1g	
I 33 3	Spare				
I 33.4	Charger common fault		BA00 - b16	XA 1d	
I 33 5	Sump pump motor ON		BA00 - b17	XF 1b	
I 33.6	MCB Tripped		BA00 - b18	K4 - A1	
I 33.7	CW Reverse rotation		BA00 - b19	XC	
Digital Output					
Q 32 0	CW pump trip signal		BA00 a2	K1 - A1	
Q 32 1	CLOSE back up valve command		BA00 a3	D1	K2 - A1
Q 32.2	OPEN back up valve command		BA00 a4	K3 - A1	
Q 32 3	Spare		BA00 a5		
Q 32 4	OPEN / TOPUP ACV command		BA00 a6	XD 2b	
Q 32.5	Close ACV command		BA00 a7	D2	XD 2c
Q 32 6	START sump pump command		BA00 a8	XF 1c	
Q 32.7	Spare		BA00 a9		
Q 33.0	PLC Healthy		BA00 a12	K5 - A1	
Q 33.1	CW pump system fault		BA00 a13	D3	XG 1a

Q 33.3	Spare		BA00 a15		
Q 33 4	Spare		BA00 a16		
Q 33 5	Spare		BA00 a17		
Q 33 6	Spare		BA00 a18		
Q 33 7	Spare		BA00 a19		
Q1	Main circuit breaker				
Q2	PLC CPU				
Q3	BA01				
Q4	BA02				
Q5	BA03				
Q6	BA04				
Q7	CW pump VCB check back				
Q8	ACV limits				
Q9	Back up valve limits				
Q10	Charger and sump pump feedback				
Q11	BA00 digital output supply				
Q12	OLM				
Q13	OP25				
F1	PM				
F2	Lamp test				
F3	Freq to current convertor & Rev Rotation				
F4	CW cooling flow transmittor				



REV	REMARKS	DATE	SIG	ESKOM DUVHA POWER STATION NORTH CW A & B PUMPS PLC INTERNAL POWER DISTRIBUTION CIRCUIT DIAGRAM	© LD TAYLOR & ASSOCIATES cc	ESKOM DRG No	
0	AS BUILT	1/02/99	LDT			REV.	SHT
					REG NO ck/96/43307/23	DRG NO 1	
						SHT 2+	

PLC CUBICLE
S5 95U
+0*JJ**



REV.	REMARKS	DATE	SIG	ESKOM DUVHA POWER STATION NORTH CW A & B PUMPS PLC ON BOARD ANALOG INPUTS CIRCUIT DIAGRAM	© LD TAYLOR & ASSOCIATES cc	ESKOM DRG. No.	
0	AS BUILT	1/02/99	LDT			REV	SHT
					REG NO ck/96/43307/23	DRG NO. 2	SHT 1-

PLC CUBICLE
S5 95U
+0*JJ**

DRG No.1/1+

BA01

3L+

0V BUSBAR

1

2

6ES5 464 8ME11
ANALOG INPUT MODULE

IW64

IW66

IW68

IW70

+BA01

3 4

-XB

1a 1b
+ - 4 20mA

5 6

1c 1d
+ - 4 20mA

7 8

1e 1f
+ - 4 20mA

9 10

1g 1h
+ - 4 20mA

+KV11

1 2

3 4

5 6

7 8

MTR HARTING
PLUG

1 2

3 4

1 2

PUMP HARTING PLUG

3 4

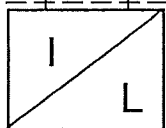
MTR SPLITTER BOX

1 2

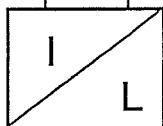
3 4

PUMP SPLITTER BOX

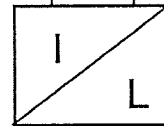
3 4



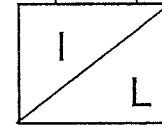
UPR MTR BRG
OIL LVL
20VC**L501



LWR MTR BRG
OIL LVL
20VC**L502

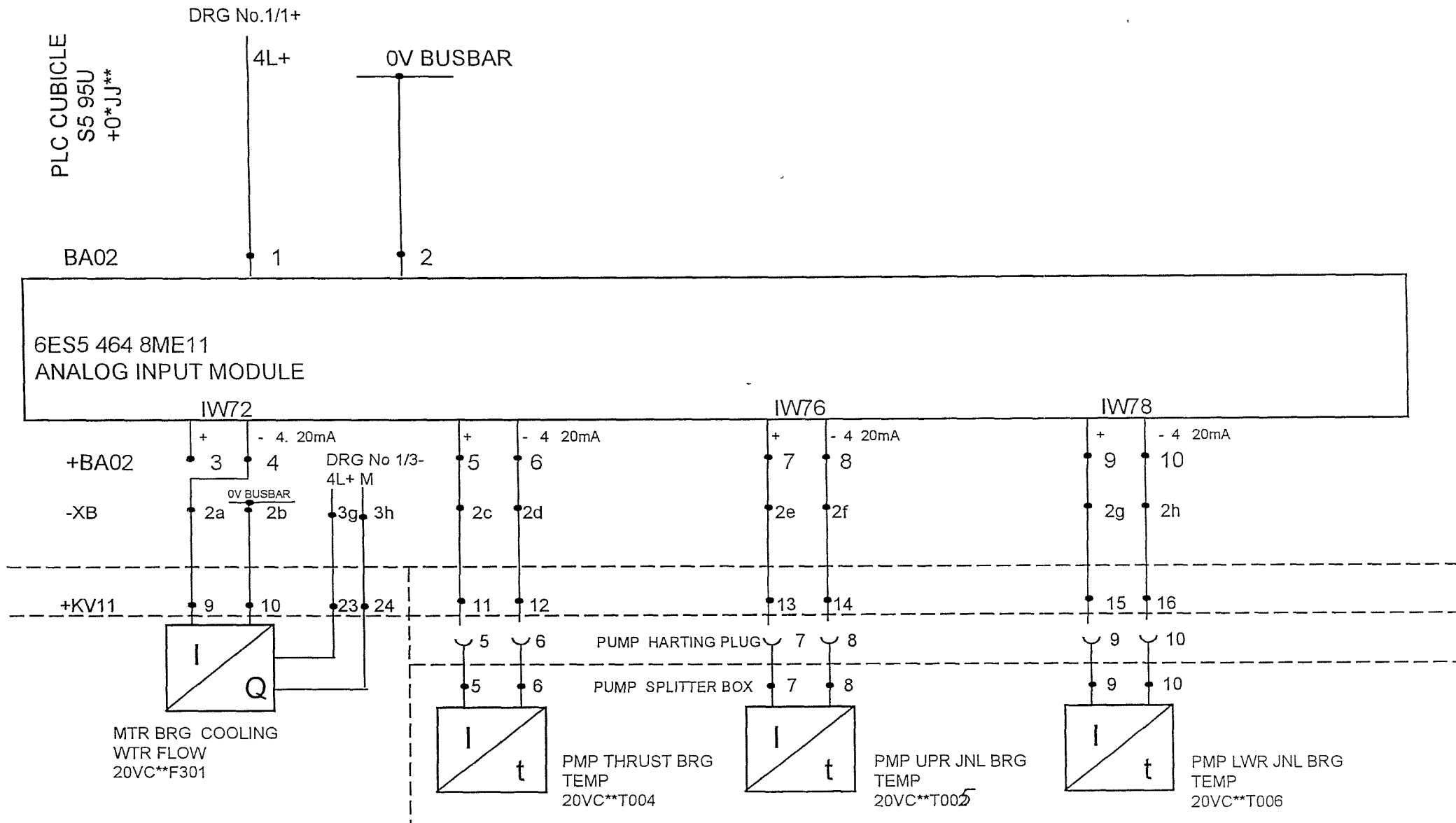


UPR PMP BRG
OIL LVL
20VC**L503



LWR PMP BRG
OIL LVL
20VC**L504

REV .	REMARKS	DATE	SIG.	ESKOM DUVHA POWER STATION NORTH CWA & B PUMPS PLC MTR & PMP ANALOG INPUTS CIRCUIT DIAGRAM	© LD TAYLOR & ASSOCIATES cc REG NO ck/96/43307/23	ESKOM DRG No. REV SHT	
0	AS BUILT	1/02/99	LDT				
1	PUMP SPLITTER BOX ADDED	14/3/99	LDT			DRG NO 3 SHT 1+	



REV.	REMARKS	DATE	SIG.	ESKOM DUVHA POWER STATION NORTH CW A & B PUMPS PLC MTR & PMP ANALOG INPUTS CIRCUIT DIAGRAM	© LD TAYLOR & ASSOCIATES cc REG NO ck/96/43307/23	ESKOM DRG No
0	AS BUILT	1/02/99	LDT			REV SHT
1	PUMP SPLITTER BOX ADDED	14/3/99	LDT			DRG NO 3
						SHT 2+

PLC CUBICLE
S5 95U
+0*JJ**

DRG No 1/1+

BA03

5L+

0V BUSBAR

1

2

6ES5 464 8ME11
ANALOG INPUT MODULE

IW80

IW82

IW84

IW86

+BA03

+ 3 - 4 20mA

-XB

3a 3b

+KV11

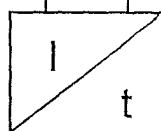
17 18

MTR HARTING
PLUG

5 6

MTR SPLITTER BOX

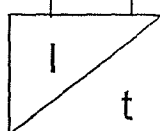
5 6



MTR THRUST BRG
TEMP
20VC**T001

7 8

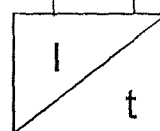
7 8



MTR UPR JNL BRG
TEMP
20VC**T002

9 10

9 10



MTR LWR JNL BRG
TEMP
20VC**T003

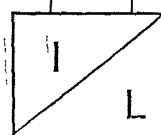
+ 7 - 4 20mA

3e 3f

21 22

+ 9 - 4 20mA

1 2



WTR SUMP LVL
20VC**L305

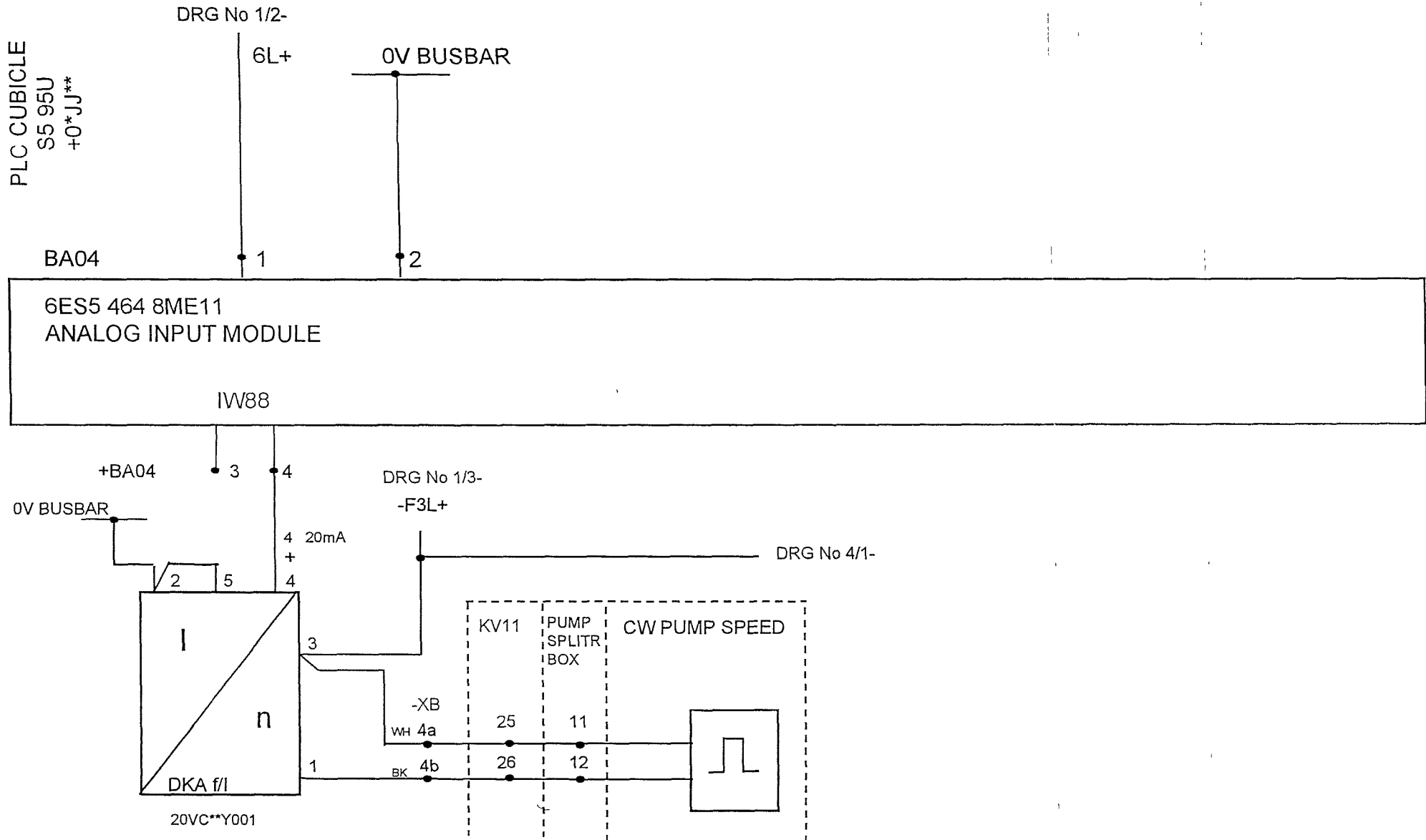
N L1
-XH 8 9

OV BUSBAR

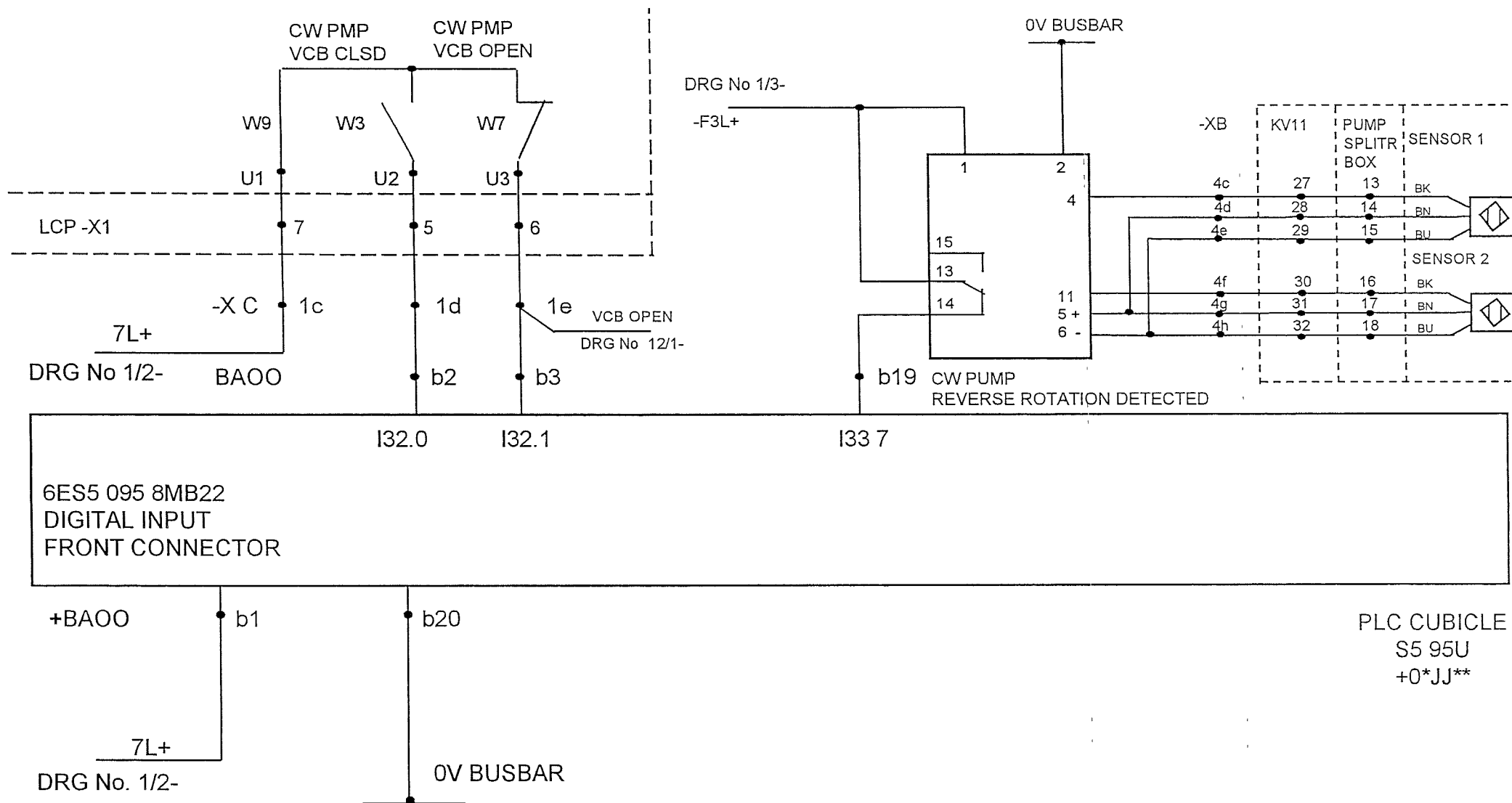
220v AC

MILLTRONICS
MULTIRANGER PLUS

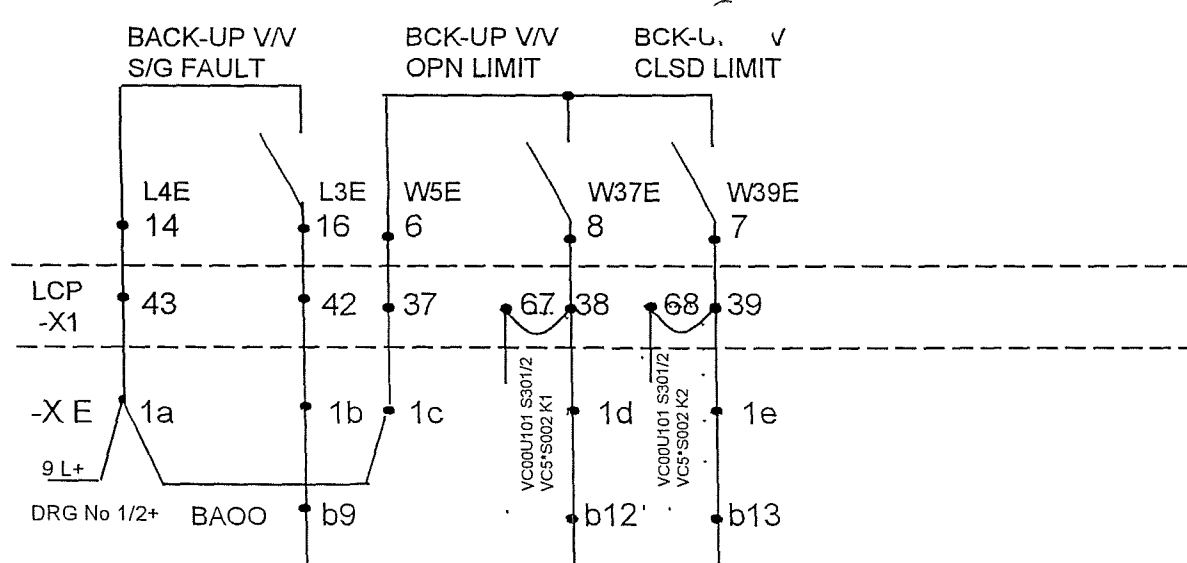
REV.	REMARKS	DATE	SIG.	ESKOM DUVHA POWER STATION	© LD TAYLOR & ASSOCIATES, cc	ESKOM DRG. No
0	AS BUILT	1/02/99	LDT	NORTH CWA & B PUMPS PLC		REV SHT.
1	PUMP SPLITTER BOX ADDED	14/3/99	LDT	MTR & PMP ANALOG INPUTS		DRG NO. 3
				CIRCUIT DIAGRAM	REG NO ck/96/43307/23	SHT 3+



REV	REMARKS	DATE	SIG	ESKOM DUVHA POWER STATION	© LD TAYLOR & ASSOCIATES cc	ESKOM DRG No
0	AS BUILT	1/02/99	LDT	NORTH CW A & B PUMPS PLC		REV. SHT
1	REVERSE ROTATION ADDED	11/3/99	LDT	MTR & PMP ANALOG INPUTS		DRG NO. 3
				CIRCUIT DIAGRAM	REG NO ck/96/43307/23	SHT 4-



REV .	REMARKS	DATE	SIG	ESKOM DUVHA POWER STATION	© LD TAYLOR & ASSOCIATES cc	ESKOM DRG No
0	AS BUILT	1/02/99	LDT	NORTH CW A & B PUMPS PLC		REV SHT.
1	REVERSE ROTATION ADDED	11/3/99	LDT	CW PUMP SWITCHGEAR		DRG NO. 4
				DIGITAL INPUTS	REG NO ck/96/43307/23	SHT 1-
				CIRCUIT DIAGRAM		

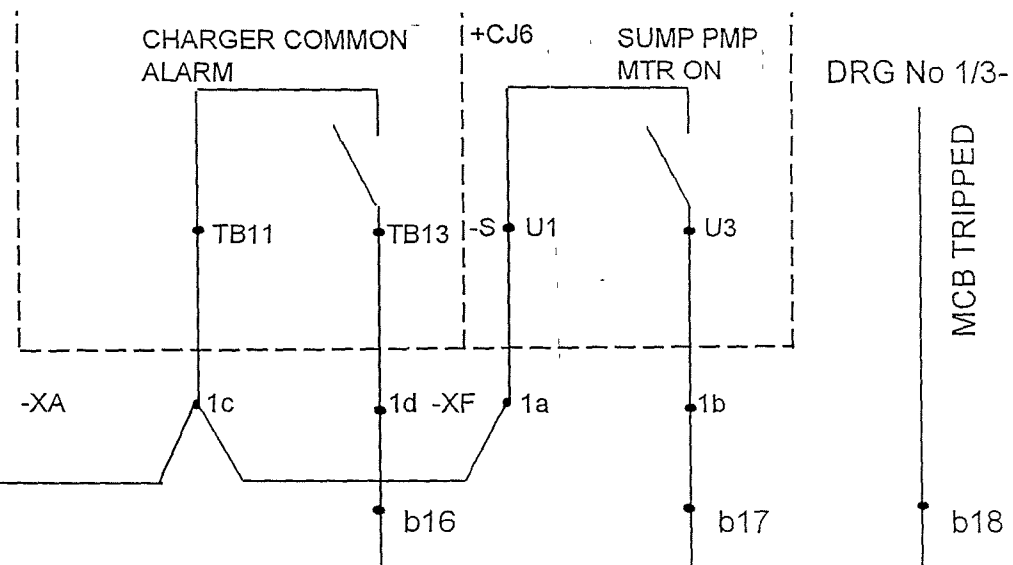


PLC CUBICLE
S5 95U
+0*JJ09

6ES5 095 8MB22
DIGITAL INPUT
FRONT CONNECTOR

REV.	REMARKS	DATE	SIG.	ESKOM DUVHA POWER STATION NORTH CW A & B PUMPS PLC BACK-UP V/V SWITCHGEAR DIGITAL INPUTS CIRCUIT DIAGRAM	© LD TAYLOR & ASSOCIATES cc	ESKOM DRG No	
0	AS BUILT	1/02/99	LDT			REV	SHT
					REG NO ck/96/43307/23	DRG NO 6	SHT 1-

PLC CUBICLE
S5 95U
+0*JJ**



10L+
DRG No.1/2+

BAOO

6ES5 095 8MB22
DIGITAL INPUT
FRONT CONNECTOR

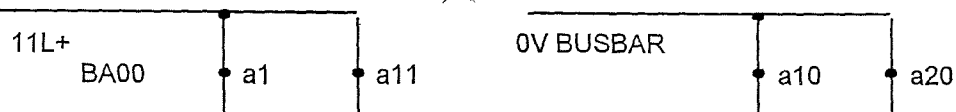
I33.4

I33 5

I33 6

REV .	REMARKS	DATE	SIG.	ESKOM DUVHA POWER STATION NORTH CWA & B PUMPS PLC BAT CHGR & SUMP PUMP SWITCHGEAR DIGITAL INPUTS CIRCUIT DIAGRAM	© LD TAYLOR & ASSOCIATES cc	ESKOM DRG No	
0	AS BUILT	1/02/99	LDT			REV	SHT
					REG NO ck/96/43307/23	DRG NO 7	
						SHT 1-	

DRG No 1/2+



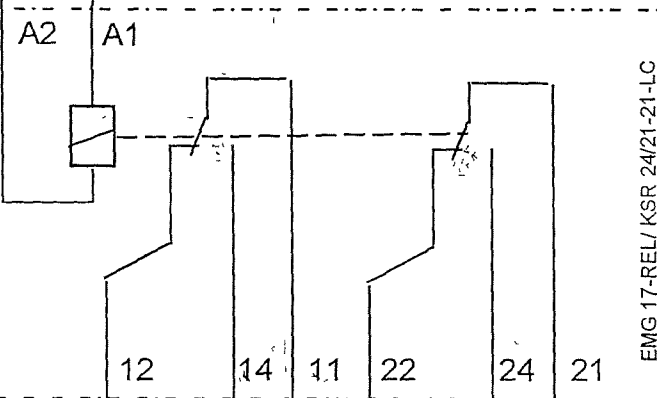
6ES5 095 8MB22
DIGITAL OUTPUT
FRONT CONNECTOR

Q 32 0

+BA00

0V BUSBAR

-K1



EMG 17-REL/ KSR 24/21-21-LC

12 14 11 22 24 21

-XH 1 2 3 4

LCP -X1

CW PMP 6A
TRIP

220V DC

k5 2

k1 1

k19 4

CW PMP 6A
READY

220V DC

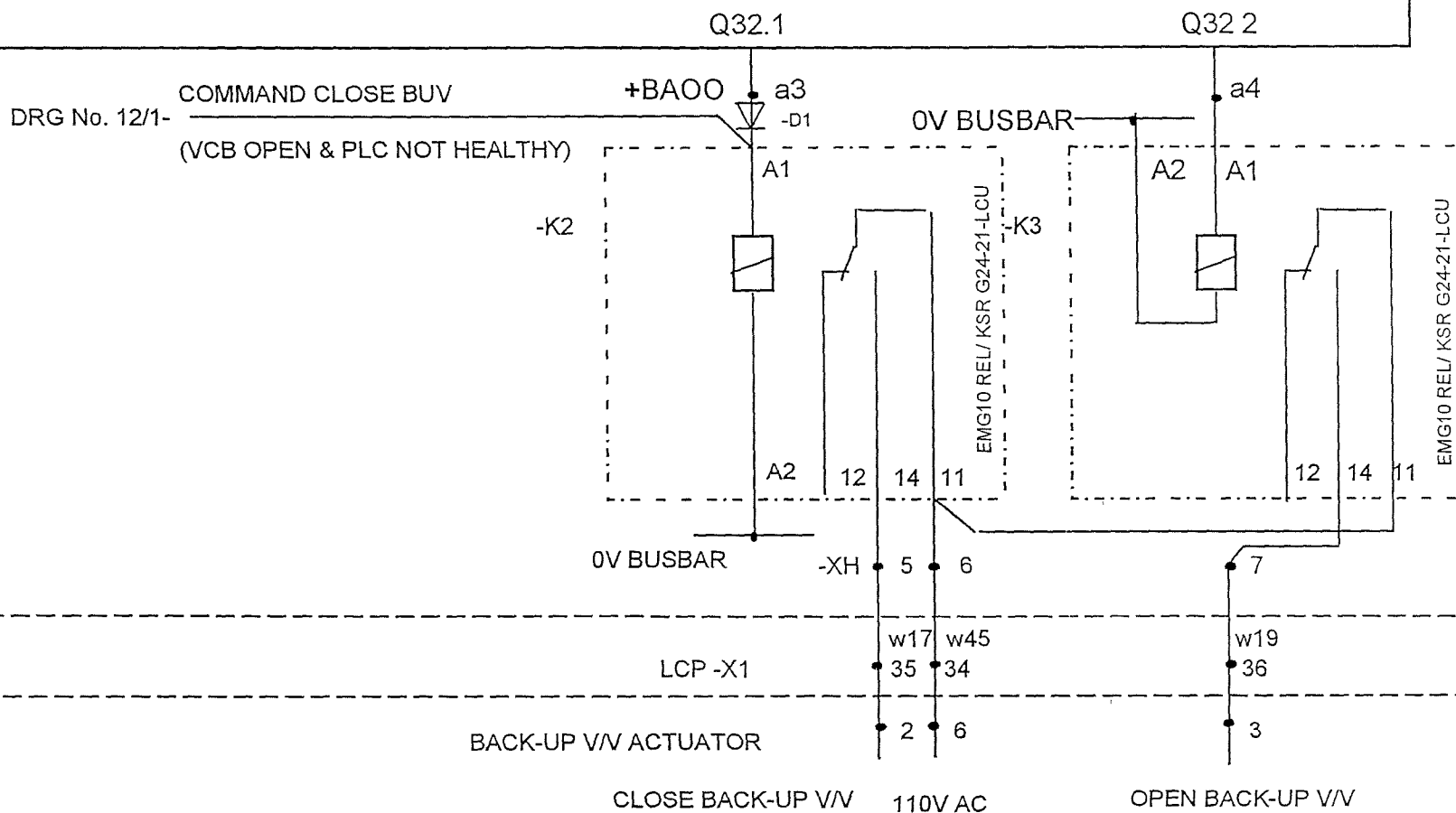
k13 3

REV.	REMARKS	DATE	SIG.	ESKOM DUVHA POWER STATION NORTH CW-A & B PUMPS PLC CW PUMP SWITCHGEAR DIGITAL OUTPUTS CIRCUIT DIAGRAM	© LD TAYLOR & ASSOCIATES CC	ESKOM DRG No.	
0	AS BUILT	1/02/99	LDT			REV	SHT
					REG NO ck/96/43307/23	DRG NO 8	SHT 1-

PLC CUBICLE
S5 95U
+0*JJ**

6ES5 095 8MB22
DIGITAL OUTPUT
FRONT CONNECTOR

PLC CUBICLE
S5 95U
+0*JJ**



REV.	REMARKS	DATE	SIG.	ESKOM DUVHA POWER STATION	© LD TAYLOR & ASSOCIATES cc	ESKOM DRG. No
0	AS BUILT	1/02/99	LDT	NORTH CWA & B PUMPS PLC BACK-UP V/V SWITCHGEAR		REV SHT.
				DIGITAL OUTPUTS	REG NO ck/96/43307/23	DRG NO 9
				CIRCUIT DIAGRAM		SHT 1-

6ES5 095 8MB22
DIGITAL OUTPUT
FRONT CONNECTOR

Q32 3

Q32 4

Q32 5

+BA00

a5

a6

a7



-D2

0V BUSBAR

COMMAND CLOSE ACV

DRG No 12/1-

(VCB OPEN & PLC NOT HEALTHY)

-XD

2a

2b

2c

2d

LCP -X1

w3

23

w7

25

w4

24

ACV
SWITCHGEAR

OPEN/TOP-UP
ACV

CLOSE ACV

PLC CUBICLE
S5 95U
+0*JJ**

REV.	REMARKS	DATE	SIG.	ESKOM DUVHA POWER STATION	© LD TAYLOR & ASSOCIATES cc	ESKOM DRG. No
0	AS BUILT	1/02/99	LDT	NORTH CWA & B PUMPS PLC AUTO CLOSE V/V SWITCHGEAR DIGITAL OUTPUTS CIRCUIT DIAGRAM	REG NO ck/96/43307/23	REV. SHT
						DRG NO 10
						SHT 1-

6ES5 095 8MB22
DIGITAL OUTPUT
FRONT CONNECTOR

Q32 6

+BA00

a8

0V BUSBAR

-XF

1c

1d

PLC CUBICLE
S5 95U
+0*JJ**

+CJ6
SUMP PUMP
SWITCHGEAR

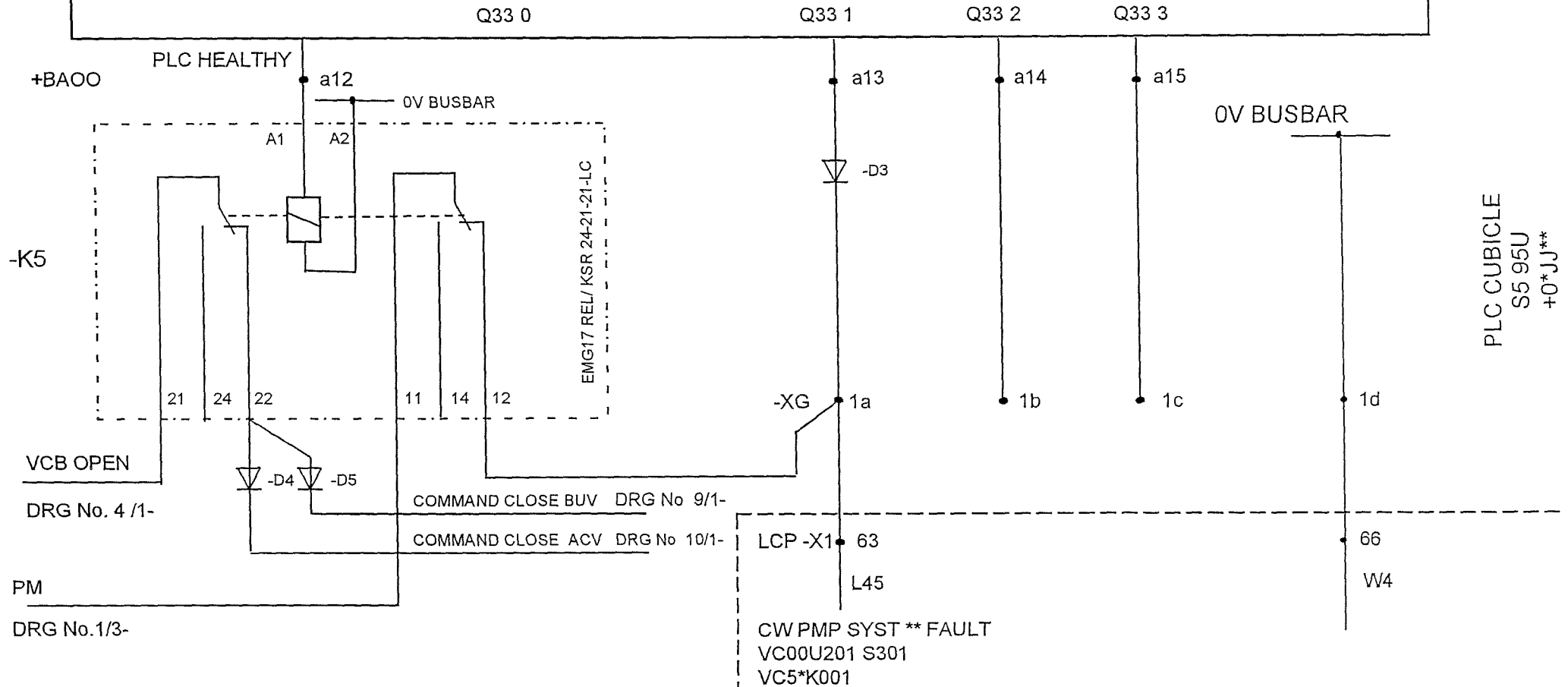
-S1 12

13

START SUMP
PUMP

REV.	REMARKS	DATE	SIG.	ESKOM DUVHA POWER STATION NORTH CWA & B PUMPS PLC SUMP PUMP SWITCHGEAR DIGITAL OUTPUTS CIRCUIT DIAGRAM	© LD TAYLOR & ASSOCIATES cc	ESKOM DRG. No	
0	AS BUILT	1/02/99	LDT			REV	SHT
					REG NO ck/96/43307/23	DRG NO. 11	SHT 1-

6ES5 095 8MB22
DIGITAL OUTPUT
FRONT CONNECTOR



REV.	REMARKS	DATE	SIG	ESKOM DUVHA POWER STATION	© LD TAYLOR & ASSOCIATES cc	ESKOM DRG No
0	AS BUILT	1/02/99	LDT	NORTH CW A & B PUMPS PLC		REV SHT.
				SYSTEM MONITORING		
				DIGITAL OUTPUTS	REG NO ck/96/43307/23	DRG NO. 12
				CIRCUIT DIAGRAM		SHT 1-

MODULE POSITION	+BA00	+BA01	+BA02	+BA03	+BA04
SLOT NUMBER	PLC	00	01	02	03
MODULE	6ES5 095 8MB22	6ES5 464 8ME11	6ES5 464 8ME11	6ES5 464 8ME11	6ES5 464 8ME11
TYPE & NUMBER OF CHANNELS	CPU AI 8 AQ 2 DI 16 DQ 16	AI 4	AI 4	AI 4	AI 4
VOLTAGE CURRENT	0/10V 0/10V 24V 24V 0/20mA	4 20mA	4 20mA	4 .20mA	4 20mA
BYTE NUMBER	IW 40 - IW54, Q40 I32.0 - I33.7 Q32.0 - Q33.7	IW64 - IW70	IW72 - IW78	IW80 - IW86	IW88 - IW94
SUB MODULE TYPE	8k EPROM 6ES5 375 1LA15				

REV	REMARKS	DATE	SIG.	ESKOM DUVHA POWER STATION NORTH CWA & B PUMPS PLC RACK LAYOUT +BA	© LD TAYLOR & ASSOCIATES cc	ESKOM DRG. No	
0	AS BUILT	1/02/99	LDT			REV	SHT
					REG NO ck/96/43307/23	DRG NO. 101	SHT 1-

NORTH & SOUTH B PUMP LCP CONNECTION SCHEDULE

INCOMING				-X1	OUTGOING TO PLC				
CABLE		SIGNAL ID	CORE	TERM No.	CABLE		PLC		
TYPE	CABLE No.				No.	GROUP	CORE	TERM No.	POS
BVX19ECV	J*038	K1*		1	V**8534		2	XH	2
BVX19ECV	J*038	K5*		2	V**8534		1	XH	1
BVX19ECV	J*038	K13*		3	V**8534		4	XH	4
BVX19ECV	J*038	K19*		4	V**8534		3	XH	3
BVX19ECV	J*038	W3*		5	V**8528	1P	YE	XC1	D
BVX19ECV	J*038	W7*		6	V**8528	1P	GN	XC1	E
BVX19ECV	J*038	W9*		7	V**8528	1P	GY	XC1	C
BVX19ECV	J*038	C133*		8	V**8528	1P	BL	XC1	A
BVX19ECV	J*038	C134*		9	V**8528	1P	RD	XC1	B
BVX19ECV	J*038	K2*		10	SPARE				
BVX19ECV	J*038	K3*		11	SPARE				
BVX19ECV	J*038	K7*		12	SPARE				
BVX19ECV	J*038	K15*		13	SPARE				
BVX19ECV	J*038	K9*		14	SPARE				
BVX19ECV	J*038	K15*		15	SPARE				
BVX19ECV	J*038	W11*		16	SPARE				
BVX19ECV	J*038	W29*		17	SPARE				
BVX19ECV	J*038	W or X16*		18	SPARE				
BVX19ECV	J*038	W or X17*		19	SPARE				
BVX07DCV	J*017	L1*	RD	20	V**8528	2P		XD1	E
BVX07DCV	J*017	L2*	WH	21	V**8528	2P		XD1	F
BVX07DCV	J*017	W1*	BL	22	SPARE				
BVX07DCV	J*017	W3*	BN	23	V**8528	3P	RD	XD2	B
BVX07DCV	J*017	W4*	GY	24	V**8528	3P	YE	XD2	D
BVX07DCV	J*017	W7*	PP	25	V**8528	3P	GY	XD2	C
BVX07DCV	J*017	SPARE	BK	26	SPARE				
BVX07DCV	J*030	W5*		27	V**8528	2P	BL	XD1	A
BVX07DCV	J*030	W23*		28	V**8528	2P	YE	XD1	D
BVX07DCV	J*030	W21*		29	V**8528	2P	GY	XD1	C
BVX07DCV	J*030	W33*		30	V**8528	2P	RD	XD1	B
BVX07DCV	J*030	W4*		31	V**8528	2P	WH	XD1	G
BVX07DCV	J*030	CONSECUTIVE No S		32	SPARE				
BVX07DCV	J*030	CONSECUTIVE No S		33	SPARE				
BVX12DCV	J*021	W15*		34	V**8534		6	XH	6
BVX12DCV	J*021	W17*		35	V**8534		5	XH	5
BVX12DCV	J*021	W19*		36	V**8534		7	XH	7
BVX12DCV	J*021	W45*		37	V**8528	4P	GY	XE1	C
BVX12DCV	J*021	W37*		38	V**8528	4P	YE	XE1	D
BVX12DCV	J*021	W39*		39	V**8528	4P	GN	XE1	E
BVX12DCV	J*021	CONSECUTIVE No S		40	SPARE				
BVX12DCV	J*021	CONSECUTIVE No S		41	SPARE				
BVX12DCV	J*021	L3*		42	V**8528	4P	RD	XE1	B
BVX12DCV	J*021	L4*		43	V**8528	4P	BL	XE1	A
BVX12DCV	J*021	CONSECUTIVE No S		44	SPARE				
BVX12DCV	J*021	CONSECUTIVE No S		45	SPARE				
BVX3DCV	J*011	K10		46	V**8534		8	XH	8
BVX3DCV	J*011	K15		47	V**8534		9	XH	9
		SPARE		48	V**8534		10	XH	10
		SPARE		49	V**8534		11	XH	11
		SPARE		50	V**8534		12	XH	12
		SPARE		51	V**8528	1P		XC1	F

NORTH & SOUTH B PUMP LCP CONNECTION SCHEDULE

INCOMING				-X1	OUTGOING TO PLC				
CABLE		SIGNAL ID	CORE	TERM No.	CABLE			PLC	
TYPE	CABLE No.				No.	GROUP	CORE	TERM No.	POS
		SPARE		52	V**8528	1P	WH	XC1	G
		SPARE		53	V**8528	1P	BK	XC1	H
		SPARE		54	V**8528	2P	BK	XD1	H
		SPARE		55	V**8528	3P	BL	XD2	A
		SPARE		56	V**8528	3P	GN	XD2	E
		SPARE		57	V**8528	3P	BN	XD2	F
		SPARE		58	V**8528	3P	WH	XD2	G
		SPARE		59	V**8528	3P	BK	XD2	H
		SPARE		60	V**8528	4P	BN	XE1	F
		SPARE		61	V**8528	4P	WH	XE1	G
		SPARE		62	V**8528	4P	BK	XE1	H
		SPARE		63	V**8528	5P	BL	XG1	A
BVX7DCV	Y* 1381	L45		64					
BVX7DCV	Y* 1381	W33		65					
BVX7DCV	Y* 1381	W35(W21)		66	V**8528	5P	YE	XG1	D
BVX7DCV	Y* 1381	W4		67					
BVX7DCV	Y* 1381	W37		68					
BVX7DCV	Y* 1381	W39		69	SPARE				
BVX7DCV	Y* 1381	CONSECUTIVE No		70	SPARE				
		SPARE		71	SPARE				
		SPARE		72	SPARE				

Duvha Power Station CW Pump 6A PLC
Prepared by LD Taylor Associates

INCOMING								TERM No.	OUTGOING TO PLC				
			SPLITTER						CABLE			PLC	
AKZ	CABLE No.	CORE	BOX	CABLE No.	CORE	PLUG	CORE		No.	GROUP	CORE	TERM No.	POS
20VC**L501	U*8041	BL	1	U*88040	BL/1P	1	BL	1	U*8039	1P	BL	XB1	A
20VC**L501	U*8041	RD	2	U*88040	RD/1P	2	RD	2	U*8039	1P	RD	XB1	B
20VC**L502	U*8042	BL	3	U*88040	GY/1P	3	GY	3	U*8039	1P	GY	XB1	C
20VC**L502	U*8042	RD	4	U*88040	YE/1P	4	YE	4	U*8039	1P	YE	XB1	D
20VC**L503	U*8043	BL					BL	5	U*8039	1P	GN	XB1	E
20VC**L503	U*8043	RD					RD	6	U*8039	1P	BN	XB1	F
20VC**L504	U*8044	BL					BL	7	U*8039	1P	WH	XB1	G
20VC**L504	U*8044	RD					RD	8	U*8039	1P	BK	XB1	H
20VC**F301	U*8045	GY					GY	9	U*8039	2P	BL	XB2	A
20VC**F301	U*8045	YE					YE	10	U*8039	2P	RD	XB2	B
20VC**T004	U*8046	BL					BL	11	U*8039	2P	GY	XB2	C
20VC**T004	U*8046	RD					RD	12	U*8039	2P	YE	XB2	D
20VC**T002	U*8047	BL					BL	13	U*8039	2P	GN	XB2	E
20VC**T002	U*8047	RD					RD	14	U*8039	2P	BN	XB2	F
20VC**T006	U*8048	BL					BL	15	U*8039	2P	WH	XB2	G
20VC**T006	U*8048	RD					RD	16	U*8039	2P	BK	XB2	H
20VC**T001	U*8049	BL	5	U*88040	GN/1P	5	GN	17	U*8039	3P	BL	XB3	A
20VC**T001	U*8049	RD	6	U*88040	BN/1P	6	BN	18	U*8039	3P	RD	XB3	B
20VC**T002	U*8050	BL	7	U*88040	WH/1P	7	WH	19	U*8039	3P	GY	XB3	C
20VC**T002	U*8050	RD	8	U*88040	BK/1P	8	BK	20	U*8039	3P	YE	XB3	D
20VC**T003	U*8051	BL	9	U*88040	BL/2P	9	BL	21	U*8039	3P	GN	XB3	E
20VC**T003	U*8051	RD	10	U*88040	RD/2P	10	RD	22	U*8039	3P	BN	XB3	F
20VC**F301	U*8045	BL					BL	23	U*8039	3P	WH	XB3	G
20VC**F301	U*8045	RD					RD	24	U*8039	3P	BK	XB3	H
								25	U*8039	4P	BL	XB4	A
								26	U*8039	4P	RD	XB4	B
								27	U*8039	4P	GY	XB4	C
								28	U*8039	4P	YE	XB4	D
PMP SPEED	U*8055	?					?	29	U*8039	4P	GN	XB4	E
PMP SPEED	U*8055	?					?	30	U*8039	4P	BN	XB4	F
	SPARE							31	U*8039	4P	WH	XB4	G
	SPARE							32	U*8039	4P	BK	XB4	H

ALL SPARE CORES TO BE LUGGED, INSULATED

AND FOLDED NEATLY IN TRUNKING

NORTH & SOUTH *A PUMP LCP CONNECTION SCHEDULE

INCOMING				-X1	OUTGOING TO PLC				
CABLE				TERM	CABLE			PLC	
TYPE	CABLE No.	SIGNAL ID	CORE	No.	No.	GROUP	CORE	TERM No.	POS
BVX19ECV	J*037	K1*		1	V**8534		2	XH	2
BVX19ECV	J*037	K5*		2	V**8534		1	XH	1
BVX19ECV	J*037	K13*		3	V**8534		4	XH	4
BVX19ECV	J*037	K19*		4	V**8534		3	XH	3
BVX19ECV	J*037	W3*		5	V**8528	1P	YE	XC1	D
BVX19ECV	J*037	W7*		6	V**8528	1P	GN	XC1	E
BVX19ECV	J*037	W9*		7	V**8528	1P	GY	XC1	C
BVX19ECV	J*037	C133*		8	V**8528	1P	BL	XC1	A
BVX19ECV	J*037	C134*		9	V**8528	1P	RD	XC1	B
BVX19ECV	J*037	K2*		10	SPARE				
BVX19ECV	J*037	K3*		11	SPARE				
BVX19ECV	J*037	K7*		12	SPARE				
BVX19ECV	J*037	K15*		13	SPARE				
BVX19ECV	J*037	K9*		14	SPARE				
BVX19ECV	J*037	K15*		15	SPARE				
BVX19ECV	J*037	W11*		16	SPARE				
BVX19ECV	J*037	W29*		17	SPARE				
BVX19ECV	J*037	W or X16*		18	SPARE				
BVX19ECV	J*037	W or X17*		19	SPARE				
BVX07DCV	J*002	L1*	RD	20	V**8528	2P		XD1	E
BVX07DCV	J*002	L2*	WH	21	V**8528	2P		XD1	F
BVX07DCV	J*002	W1*	BL	22	SPARE				
BVX07DCV	J*002	W3*	BN	23	V**8528	3P	RD	XD2	B
BVX07DCV	J*002	W4*	GY	24	V**8528	3P	YE	XD2	D
BVX07DCV	J*002	W7*	PP	25	V**8528	3P	GY	XD2	C
BVX07DCV	J*002	SPARE	BK	26	SPARE				
BVX07DCV	J*019	W5*		27	V**8528	2P	BL	XD1	A
BVX07DCV	J*019	W23*		28	V**8528	2P	YE	XD1	D
BVX07DCV	J*019	W21*		29	V**8528	2P	GY	XD1	C
BVX07DCV	J*019	W33*		30	V**8528	2P	RD	XD1	B
BVX07DCV	J*019	W4*		31	V**8528	2P	WH	XD1	G
BVX07DCV	J*019	CONSECUTIVE No S		32	SPARE				
BVX07DCV	J*019	CONSECUTIVE No S		33	SPARE				
BVX12DCV	J*020	W15*		34	V**8534		6	XH	6
BVX12DCV	J*020	W17*		35	V**8534		5	XH	5
BVX12DCV	J*020	W19*		36	V**8534		7	XH	7
BVX12DCV	J*020	W45*		37	V**8528	4P	GY	XE1	C
BVX12DCV	J*020	W37*		38	V**8528	4P	YE	XE1	D
BVX12DCV	J*020	W39*		39	V**8528	4P	GN	XE1	E
BVX12DCV	J*020	CONSECUTIVE No S		40	SPARE				
BVX12DCV	J*020	CONSECUTIVE No S		41	SPARE				
BVX12DCV	J*020	L3*		42	V**8528	4P	RD	XE1	B
BVX12DCV	J*020	L4*		43	V**8528	4P	BL	XE1	A
BVX12DCV	J*020	CONSECUTIVE No S		44	SPARE				
BVX12DCV	J*020	CONSECUTIVE No S		45	SPARE				
BVX3DCV	J*008	K10		46	V**8534		8	XH	8
BVX3DCV	J*008	K15		47	V**8534		9	XH	9
		SPARE		48	V**8534		10	XH	10
		SPARE		49	V**8534		11	XH	11
		SPARE		50	V**8534		12	XH	12
		SPARE		51	V**8528		1P	XC1	F

Duvha Power Station CW Pump *A PLC
Prepared by LD Taylor & Associates

NORTH & SOUTH *A PUMP LCP CONNECTION SCHEDULE

INCOMING				-X1	OUTGOING TO PLC				
CABLE		SIGNAL ID	CORE	TERM No.	CABLE			PLC	
TYPE	CABLE No.				No.	GROUP	CORE	TERM No.	POS
		SPARE		52	V**8528	1P	WH	XC1	G
		SPARE		53	V**8528	1P	BK	XC1	H
		SPARE		54	V**8528	2P	BK	XD1	H
		SPARE		55	V**8528	3P	BL	XD2	A
		SPARE		56	V**8528	3P	GN	XD2	E
		SPARE		57	V**8528	3P	BN	XD2	F
		SPARE		58	V**8528	3P	WH	XD2	G
		SPARE		59	V**8528	3P	BK	XD2	H
		SPARE		60	V**8528	4P	BN	XE1	F
		SPARE		61	V**8528	4P	WH	XE1	G
		SPARE		62	V**8528	4P	BK	XE1	H
		SPARE		63	V**8528	5P	BL	XG1	A
		SPARE		64					
		SPARE		65					
BVX7DCV	Y* 1382	L45		66	V**8528	5P	YE	XG1	D
BVX7DCV	Y* 1382	W33		67					
BVX7DCV	Y* 1382	W35(W21)		68					
BVX7DCV	Y* 1382	W4		69	SPARE				
BVX7DCV	Y* 1382	W37		70	SPARE				
BVX7DCV	Y* 1382	W39		71	SPARE				
BVX7DCV	Y* 1382	CONSECUTIVE No		72	SPARE				
		SPARE							
		SPARE							
		SPARE							
		SPARE							

Duvha Power Station CW Pump 6A PLC
Prepared by LD Taylor Associates

INCOMING								TERM No.	OUTGOING TO PLC				
AKZ	CABLE No.	CORE	SPLITTER BOX	CABLE No.	CORE	PLUG	CORE		CABLE No.	GROUP	CORE	PLC TERM No.	POS
20VC**L501	U*8041	BL	1	U*88040	BL/1P	1	BL	1	U*8039	1P	BL	XB1	A
20VC**L501	U*8041	RD	2	U*88040	RD/1P	2	RD	2	U*8039	1P	RD	XB1	B
20VC**L502	U*8042	BL	3	U*88040	GY/1P	3	GY	3	U*8039	1P	GY	XB1	C
20VC**L502	U*8042	RD	4	U*88040	YE/1P	4	YE	4	U*8039	1P	YE	XB1	D
20VC**L503	U*8043	BL					BL	5	U*8039	1P	GN	XB1	E
20VC**L503	U*8043	RD					RD	6	U*8039	1P	BN	XB1	F
20VC**L504	U*8044	BL					BL	7	U*8039	1P	WH	XB1	G
20VC**L504	U*8044	RD					RD	8	U*8039	1P	BK	XB1	H
20VC**F301	U*8045	GY					GY	9	U*8039	2P	BL	XB2	A
20VC**F301	U*8045	YE					YE	10	U*8039	2P	RD	XB2	B
20VC**T004	U*8046	BL					BL	11	U*8039	2P	GY	XB2	C
20VC**T004	U*8046	RD					RD	12	U*8039	2P	YE	XB2	D
20VC**T005	U*8047	BL					BL	13	U*8039	2P	GN	XB2	E
20VC**T005	U*8047	RD					RD	14	U*8039	2P	BN	XB2	F
20VC**T006	U*8048	BL					BL	15	U*8039	2P	WH	XB2	G
20VC**T006	U*8048	RD					RD	16	U*8039	2P	BK	XB2	H
20VC**T001	U*8049	BL	5	U*88040	GN/1P	5	GN	17	U*8039	3P	BL	XB3	A
20VC**T001	U*8049	RD	6	U*88040	BN/1P	6	BN	18	U*8039	3P	RD	XB3	B
20VC**T002	U*8050	BL	7	U*88040	WH/1P	7	WH	19	U*8039	3P	GY	XB3	C
20VC**T002	U*8050	RD	8	U*88040	BK/1P	8	BK	20	U*8039	3P	YE	XB3	D
20VC**T003	U*8051	BL	9	U*88040	BL/2P	9	BL	21	U*8039	3P	GN	XB3	E
20VC**T003	U*8051	RD	10	U*88040	RD/2P	10	RD	22	U*8039	3P	BN	XB3	F
20VC**F301	U*8045	BL					BL	23	U*8039	3P	WH	XB3	G
20VC**F301	U*8045	RD					RD	24	U*8039	3P	BK	XB3	H
								25	U*8039	4P	BL	XB4	A
								26	U*8039	4P	RD	XB4	B
								27	U*8039	4P	GY	XB4	C
								28	U*8039	4P	YE	XB4	D
PMP SPEED	U*8055	?					?	29	U*8039	4P	GN	XB4	E
PMP SPEED	U*8055	?					?	30	U*8039	4P	BN	XB4	F
	SPARE							31	U*8039	4P	WH	XB4	G
	SPARE							32	U*8039	4P	BK	XB4	H

ALL SPARE CORES TO BE LUGGED, INSULATED

AND FOLDED NEATLY IN TRUNKING

-XA CONNECTION SCHEDULE

ORIGIN: BATTERY CHARGER					CABLE		TARGET: PLC -XA	
CABLE TYPE	CABLE No.	AKZ	LOCATION	TERM No.	GROUP	CORE	TERM No.	POS
TAILS FROM BATTERY CHARGER					SPARE		1	A
				SPARE			1	B
				TB11			1	C
				TB13			1	D
				SPARE			1	E
				SPARE			1	F
				SPARE			1	G
				SPARE			1	H

Prepared by LD Taylor & Associates

-XB CONNECTION SCHEDULE

[illegible]

-XC CONNECTION SCHEDULE

ORIGIN: SWITCHGEAR					CABLE		TARGET: PLC	
CABLE TYPE	CABLE No.	AKZ	LOCATION	TERM No.	GROUP	CORE	TERM No.	POS
UVG20ACV	V** 8528		LCP -X1	8	1P	BL	1	A
UVG20ACV	V** 8528		LCP -X1	9	1P	RD	1	B
UVG20ACV	V** 8528		LCP -X1	7	1P	GY	1	C
UVG20ACV	V** 8528		LCP -X1	5	1P	YE	1	D
UVG20ACV	V** 8528		LCP -X1	6	1P	GN	1	E
UVG20ACV	V** 8528	SPARE	LCP -X1	51	1P	BN	1	F
UVG20ACV	V** 8528	SPARE	LCP -X1	52	1P	WH	1	G
UVG20ACV	V** 8528	SPARE	LCP -X1	53	1P	BK	1	H

Duvha Power Station CW Pump *A/B PLC
Prepared by LD Taylor & Associates

-XD CONNECTION SCHEDULE

ORIGIN: AUTO CLOSE V/V SWITCHGEAR					CABLE		TARGET: PLC -XD	
CABLE TYPE	CABLE No.	AKZ	LOCATION	TERM No.	GROUP	CORE	TERM No.	POS
UVG20ACV	V** 8528		LCP -X1	27	2P	BL	1	A
UVG20ACV	V** 8528		LCP -X1	30	2P	RD	1	B
UVG20ACV	V** 8528		LCP -X1	29	2P	GY	1	C
UVG20ACV	V** 8528		LCP -X1	28	2P	YE	1	D
UVG20ACV	V** 8528		LCP -X1	20	2P	GN	1	E
UVG20ACV	V** 8528		LCP -X1	21	2P	BN	1	F
UVG20ACV	V** 8528		LCP -X1	31	2P	WH	1	G
UVG20ACV	V** 8528	SPARE	LCP -X1	54	2P	BK	1	H
UVG20ACV	V** 8528	SPARE	LCP -X1	55	3P	BL	2	A
UVG20ACV	V** 8528		LCP -X1	23	3P	RD	2	B
UVG20ACV	V** 8528		LCP -X1	25	3P	GY	2	C
UVG20ACV	V** 8528		LCP -X1	24	3P	YE	2	D
UVG20ACV	V** 8528	SPARE	LCP -X1	56	3P	GN	2	E
UVG20ACV	V** 8528	SPARE	LCP -X1	57	3P	BN	2	F
UVG20ACV	V** 8528	SPARE	LCP -X1	58	3P	WH	2	G
UVG20ACV	V** 8528	SPARE	LCP -X1	59	3P	BK	2	H
UVG02ACV	V** 8530		ACV UNIT	L21		BL	3	A
UVG02ACV	V** 8530		ACV UNIT	L22		RD	3	B
UVG02ACV	V** 8530		ACV UNIT	SPARE		GY	3	C
UVG02ACV	V** 8530		ACV UNIT	SPARE		YE	3	D

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-XE CONNECTION SCHEDULE

ORIGIN: BACK-UP V/V SWITCHGEAR					CABLE		TARGET: PLC -XE	
CABLE TYPE	CABLE No.	AKZ	LOCATION	TERM No.	GROUP	CORE	TERM No.	POS
UVG20ACV	V** 8528		LCP -X1	43	4P	BL	1	A
UVG20ACV	V** 8528		LCP -X1	42	4P	RD	1	B
UVG20ACV	V** 8528		LCP -X1	37	4P	GY	1	C
UVG20ACV	V** 8528		LCP -X1	38	4P	YE	1	D
UVG20ACV	V** 8528		LCP -X1	39	4P	GN	1	E
UVG20ACV	V** 8528	SPARE	LCP -X1	60	4P	BN	1	F
UVG20ACV	V** 8528	SPARE	LCP -X1	61	4P	WH	1	G
UVG20ACV	V** 8528	SPARE	LCP -X1	62	4P	BK	1	H

Duvha Power Station CW Pump *A/B PLC
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-XF CONNECTION SCHEDULE

[illegible]

-XG CONNECTION SCHEDULE

-XG CONN SCHEDULE
Rev 0, 7 OCTOBER 1998

-XH CONNECTION SCHEDULE

-XH CONN. SCHEDULE
rev. 1, 26 JANUARY 1999

CW Pump Control Replacement		
North CW Bill of material		
Quantity	Description	Supplied
1	2 Metre DIN Rail NS35/15 x 2 3	
1	2 Metre DIN Rail NS35/7.5	
1	95U PLC with L2 comms (6ES5 095 8MB22)	
1	Coros OP 25 MMI (6AV3525-1EA01-0AX0)	
3	Bus Module (6ES5 700 8MA11)	
1	Front connector (6ES5 490 8MB11)	
4	4 Channel analog 4 20mA Input modules (6ES5 464 8ME11)	
1	16k EPROM (6ES5 375 0LA21)	
1	63A Double Pole Isolator Merlin Gerin Multi 9	
12	2A MCB Merlin Gerin Model MG M9 C45 2A	
11	Auxiliary contacts Merlin Gerin model OF C32/C63	
2	150 mm x 10 x3 Busbars NLS-CU 3/10	
2	Double support for Busbar AB 2/SS	
20	Connecting terminal blocks Black AKG 4 BK	
10	Connecting terminal blocks Green/Yellow AKG 4 GNYE	
14	Jumping terminal blocks RV8-TP Q	
7	RV8 end covers D-RV8	
1	Pair RV8 Marking mask KZMP-RV8 A-H	
25	End brackets E/UK	
8	Terminal strip markers KLM	
7	Marker strips RBS 7.62 10 26 12 2	
3	Fuse terminals UK 5 HESI	
12	Terminal blocks grey UK2 5	
1	End cover grey D-UK 2 5	
4	Terminal blocks grey UK 4TG	
4	Terminal blocks grey insertion ST - BE	
4	1N4007 diodes	
1	Lamp/push button set	
2	5 Meter slotted trunking 40 x 40 mm grey	
25	Metre 0.5mm2 Grey wire	
10	Metre 0.5mm2 Red wire	
10	Metre 0.5mm2 Black wire	
1	Wiring numbers	
1	Bus terminal RS 485 6GK1 500 0AA00	
1	OLM/S4 optical link module 6GK1 502 4AC10	
3	Relays EMG10 REL/KSR G24-21-LC	
2	Relays EMG22 REL/KSR 24-21	
20	Cable Lables	
120	Termi point connectors	
1	500 Ohm 1/4 watt resistor	
3	D - 15 Male plug with cover	
Field Equipment		
3	Speed Probes	
1	Frequency to current converter	
1	Auto closing valve limit assembly	
6	4 - Way Pratley boxes 5975 70 0008171 SAP 0136489 GS11D1B	
6	Type K 4.20mA 0.100C Head Amplifiers 6685 70 0111837 SAP 0154313 GS36G1B	
2	Type K Thermocouple CJ115x5/16 HJ137x3/16 6685 70 0017681 SAP 0153555 GS32D1A	
4	Type K Thermocouple CJ115x5/16 HJ165x3/16 6685 70 0017683 SAP 0153557 GS32G2A	
4	Proximity Switches	
1	Reverse rotation discriminator	
15	Meter co - ax cable RG - 59	
6	11 Pin Relay bases with round edges	
6	11 Relays - 24 VDC coil with 220V 10 Amp contacts	
1	Magflo transmitter	
20	Size "O" glands SAP 0044180 GS11A5B	
6	Harting 10 Pin Mail Plug (P/NO RWF-10-M)	
6	Harting 10 Pin Female Plug (P/NO RWF-10-FM)	
6	Harting 24 Pin Male plug (P/NO RWF-24-M)	

North CW Bill of material

6	Harting 24 Pin female plug (P/NO RWF-24-FM)	
2	12 Volt Batteries	
1	Charger set of circuit breakers	
1	Charger LCD display unit	
1	Oil level Transmitters Stock No 5930 70 5484 741 (0 to 50 mm)	
3	Oil level Transmitters Stock No. 5930 70 5491 335 (0 to 150 mm)	

South CW Pump

CW Control system modification:

Cold commissioning.

Date:.....

Battery chargers.

1. Switch OFF AC Supply A and B, CB1 & CB2 in the PLC panel
2. Switch OFF all the PLC circuit breakers, Q1 to Q13
3. Measure CB4 Input 13 to be +24V and 14 for 0 Volt
4. Switch ON Battery circuit breaker, CB4
5. Switch OFF Load circuit breaker, CB3
6. Switch ON Both AC supplies on The _____ Board and _____ Boards in Sub South
7. Measure both AC supply A and B before the isolator on CB1 and CB2 in the PLC panel
 - Switch on AC supply A , CB1 and observe message on charger LCD and note
 - DC Voltage V
 - Current consumption A
 - Charging current A
 - Active Alarms
8. Switch ON AC supply B, CB2
 - Observe message on charger LCD and note
 - DC Voltage V
 - Current consumption A
 - Charging current A
 - Active Alarms:
9. Measure Voltage on the Load Circuit breaker, CB3 input to be +24Volt on point 1 and 0 volt on point 3
10. Switch Load circuit breaker, CB3 ON
11. Measure voltage on Q1 input on point 1 to be +24 Volt and on point 3 0 Volt.

PLC Commissioning

1. Insert 800 mA fuses in F1 to F4
2. Switch ON Q1 and Q2
3. Insert PLC EPROM with the Correct Pumps software loaded
4. Switch on the PLC, The program will load from the EPROM and go to RUN mode
5. Switch On Q13 – Supply to OP25 and OLM
6. Load OP 25 PLC program for the correct pump
7. Switch ON Q3 to Q12 and measure each supply as per I/O list

Function testing

OP25 Panel

1. Go To F10
2. Check time and date
3. Check that OPS, C&I and EMD password are active
4. Correct if necessary
5. Clear alarm buffer on OP 25

Input / Output Loop checking

1. With the PLC ON loop check all the inputs and outputs

Temperature function check

- 1 On OP 25 Press K2
- 2 Check that all the temperatures are reading ambient temp
- 3 Plug out one of the thermocouples. Observe the temperature reading to go to 200 Deg Celsius and alarm Pop up " Specific bearing thermocouple failed" No trip signal should initiate
- 4 Plug back the thermocouple and reset the alarm.
- 5 The exercise can be repeated with all the thermocouples if the loop checking was not completed

Bearing level transmitter function check

1. On OP 25 Press K2
2. Check that all the level transmitter reading correspond with the sight glass .
- 3 On OP 25 Press K4
- 4 Compare the actual level with the Alarm and trip value to confirm alarm status
5. In KV 11 junction box, open terminal 1 link Observe the motor upper bearing oil level go to zero and an alarm pops up "motor upper bearing oil level transmitter failed" No trip signal should initiate
6. Close the link in KV 11 and reset the alarm
- 7 The exercise can be repeated by opening the terminals 3,5 and 7 one at a time to prove the rest

ACV stroking

- 1 On OP25 select valve test mode
- 2 If the VCB is open Test mode can be switched ON
3. Type in Password
4. With the Backup valve close the ACV can be driven open
- 5 Set up the limits
 - Make a little bridge piece wire to simulate the 100% valve opening to stop the hydraulic pump when the valve reached it full open position.
 - Make sure that the pointer is loose to prevent rotation when the valve open
 - From the OP 25 open the valve
 - When the valve reaches it full open position, simulate the 100% position in the PLC cubicle XD 1a and 1b.
 - Adjust and lock the pointer opposite the 100% limit proximity switch
 - Adjust the gap of the proximity switch for 1 to 2 mm Note the proximity LED will not come on with the 100% simulation.
 - Remove the 100% simulation and note that the LED on the proximity comes ON and the hydraulic pump stays OFF and 100% position indicate on OP25 K7 screen and Unit control room.
 - Close the valve from the OP25
 - When the valve reached its close position, adjust the 0% proximity probe bracket to line up with the pointer and adjust the gap to 1 to 2 mm
 - Open the valve from the OP25 and stop the hydraulic pump with the 100% simulation in the PLC cubicle XD 1a and 1b when the pointer is opposite the 85% probe and adjust the gap to 1 to 2 mm
 - Remove the simulation, and allow the hydraulic pump to open the valve until the pointer is opposite the 90% proximity switch and adjust the proximity gap
 - From the OP25 close the valve and remove the simulation wire

- 6 From the OP25 open the ACV
- 7 Observe on Op25 screen K7 that 85% 90% and 100% limits make
- 8 Observe and note time travelling from close to open and Open to close
Time open. sec
Time close' . . sec
- 9 Close the valve from the OP25

Back up valve Function check

- 1 *The valve must be stroke checked from the local control by either EMD or the Contractor and witness team before driving it remotely*
- 2 On OP25 select valve test mode K8
3. If the VCB is open Test mode can be switched ON
- 4 Type in Password
- 5 With the ACV valve close, the backup valve can be driven open
- 6 Observe and note time travelling from close to open and Open to close
Time to Open . . Seconds
Time to close: . . Seconds

Pump Protection.

Important :

The Specific pump permit must be cleared

With breaker linked off and “**backup valve ON LOCAL or Switched OFF**” to prevent both valves to open

Check on the OP25 that all the alarms going to the control room as “CW System fault” are cleared
Q33 1 on the PLC Confirm with the control room

Protection 1: Both Backup and ACV does not open in 4 Minutes

- 1 Start CW pump from control room
2. ACV will open but backup valve NOT
- 3 The pump will trip after 4 min

Protection 2: Bearing temperature High – Trip after 2 sec

- 1 Start CW pump from control room
- 2 ACV will open but backup valve NOT
- 3 Simulate any bearing temperature higher than 85 deg celsius
- 4 The pump will trip after 2 sec

Protection 3: Bearing oil level Low – Will trip after 2 sec

- 1 Start CW pump from control room
- 2 ACV will open but backup valve NOT
- 3 Simulate any bearing oil level lower than trip value
- 4 The pump will trip after 2 sec

Protection 4: Auto closing valve hydraulic leakage excessive

- 1 Start CW pump from control room
- 2 Pull off the ACV solenoid plug in the ACV hydraulic pump assembly.

3. The ACV will immediately start closing, the hydraulic pump will start on 90% to lift the valve to 100% which will fail. The 85% limit will initiate a 4 min timer to allow the valve to 100%. If it does not reach 100% in this time or the valve reach 0% before the pump will trip. Confirm OP25 Alarm, "CW system fault" in the control room LC grid and Process computer.

Protection 5: Reverse Rotation

Not applicable for the South CW Pumps

Scenarios Testing

Scenarios A.

Description With the pump in service, the PLC fail. At this stage the pump has no protection. This state will give the operator time to start the standby pump and shut this one down.

Results expected:

1. The specific pump's common alarm will come ON in the UCR
2. The Pump will remain running and all the control room indications, Pump ON, ACV Open if not in float status, and backup valve Open limits will remain unchanged. The pump will remain in service for an unlimited time providing that the ACV valve is kept open by manually pump it up to 100% limit when required.
3. For more information regarding the specific alarm responsible for the common alarm can be viewed on the Process computer.
4. The pump can be switched OFF from the UCR. The pump will shut down and the ACV and backup valves will close automatically.

Scenarios A test.

4. Make sure of the following conditions:
 - The PLC have the correct EPROM in and backup battery for the CPU installed
 - The CW pump breaker is linked OFF and all flags are reset
 - The ACV fused up and ready for use
 - The backup valve isolated or switched to "local" to prevent opening
 - That CW Pump common alarm is cleared in UCR
5. Start CW pump from UCR and simulate backup valve open limit (on XE 1c and 1d) to prevent the breaker to trip after 4 minutes on.
6. Wait until the ACV reached 100% limit.
7. Notify the operator of your intentions and confirm that no alarms are standing.
8. Switch OFF the PLC
9. Confirm the following with the operator
 - That the alarm "CW System fault" came on (LCD Grid Facia and Computer)
 - That the pump is still ON
 - That the backup valve indicate Open (Simulated) and close limits
 - The ACV Open or NO Limit (When in control float)
10. Ask the operator to switch OFF the pump from the UCR and observe the following:
 - The CW pump breaker will OPEN
 - ACV will close
 - Backup valve for being closed will have a close command on and can be measured on XH 5 110 VAC or check LED on relay K2 ON
11. Switch the PLC ON

Scenarios B.

Description. With the pump in service, the PLC fail. At this stage the pump has no protection. This state will give the operator time to start the standby pump and shut this one down. In this case the PLC will return while the pump is still running.

Results expected:

5. The specific pump's common alarm will come ON in the UCR.
6. The Pump will remain running and all the control room indications, Pump ON, ACV Open if not in float status, and backup valve Open limits will remain unchanged. The pump will remain in service for an unlimited time providing that the ACV valve is kept open by manually pump it up to 100% limit when required.
7. For more information regarding the specific alarm responsible for the common alarm can be viewed on the Process computer.
8. The pump can be switched OFF from the UCR. The pump will shut down and the ACV and backup valves will close automatically.
9. If the pump remain running and the PLC return to service, the alarm will clear and the ACV valve will open to 100% if it was not open. Everything will return to normal.

Scenarios B testing:

1. Make sure of the following conditions
 - The PLC have the correct EPROM in and N1 backup battery for the CPU installed
 - The CW pump breaker is linked OFF and all flags are reset
 - The ACV fused up and ready for use
 - The backup valve isolated to prevent opening
 - That CW Pump common alarm is cleared in UCR
2. Start CW pump from UCR and simulate backup valve open limit (on XE 1c and 1d) to prevent the breaker to trip after 4 minutes on.
3. Wait for 4 minutes to make sure that no protection tripped the pump from startup
4. Notify the operator of your intentions and confirm that no alarms are standing
5. Switch OFF the PLC.
6. Confirm the following with the operator
 - That the alarm "CW System fault" came on (LCD Grid Facia and Computer)
 - That the pump is still ON
 - That the backup valve indicate Open (Simulated) and close limits
 - The ACV Open or NO Limit (When in control float)
7. Switch the PLC ON and observe the following
 - The CW pump will still be ON
 - If the ACV was at 100% it will remain in this state. If it was in float between 85 and 100% the hydraulic pump will start and open it to 100%
 - Backup valve will indicate Open (as simulated) and close for actual position
 - That CW Pump common alarm cleared in UCR

C&I Representative Name Print: Signature:

EMD Representative Name Print: Signature:

OPS Representative Name Print: Signature:

Project Management Representative Name Print: Signature:

Project Engineer Name Print: Signature:

Sump pump level control commissioning

Milltronic head cable connection

- From the head side , Screen and white connect with screen on co-ax cable
- From the head side , Black connect with centre core on co-ax cable

Fuse up specific CW pump's sump pump control and switch to remote to get 220 V AC supply
The Milltronic control unit LCD display will come on

With the Milltronic calibrator, configure as follow

- Press "*CAL*"
- Press "*DISP*" - a "P" number will display
Use the UP and DOWN arrows to get to the correct parameter
Press "*DISP*" to view the parameter
- Type in the correct parameters according to the list After each parameter, press "*ENTER*"
- When completed, *press* "*RUN*"

Parameter	Unit 1A	Unit 1B	Unit 2A	Unit 2B	Unit 3A	Unit 3B
P1	2	2	2	2	2	2
P2	1	1	1	1	1	1
P3	140	154	152	152	152	149
P4	28,5	28,5	28,5	28,5	28,5	28,5
P5	111 5	125 5	123 5	123 5	123 5	120 5
P6	2	2	2	2	2	2
P7	3	3	3	3	3	3
P8	0	0	0	0	0	0