

VENDOR DOCUMENT REVIEW STATUS

- ☒ A Drawing/Document approved as submitted. Proceed with fabrication/construction.
- ☐ B Drawing/Document approved subjected to comments noted. Proceed with fabrication/construction considering our comments.
- ☐ C Our comments are noted on this marked up print.
- ☐ D Our comments are noted in memo attached to the forwarding transmittal letter No. TCE5750A-IC-VDT-144, Dated 07/03/2014
- ☐ E Correct original of this drawing/document to reflect our comments and resubmit for approval.
- ☐ F Correct original of this drawing/document to reflect our comments and resubmit for records.
- ☐ G Drawings/Documents of this category are for information only and not for approval. Information furnished on the drawing/document is noted.
- ☒ H Drawing/Document reviewed against our previous comments and other revisions highlighted and identified by the vendor.
- ☐ I Drawing/Document returned without review.
- ☐ J Print not enclosed.

Approval conveyed herein neither relieves the Vendor/Contractor of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, performance requirements and conformity of the supplies with the Indian Statutory Laws as may be applicable, nor does it limit the purchaser's rights under the contract.

Reviewed by: LDS Date 07/03/2014

DRIVE CONTROL PHILOSOPHY (STATION C&I)

REV.	DATE	ALT	CHD	APPD	REV.	DATE	ALT	CHD	APPD	REV.	DATE	ALT	CHD	APPD
05	14.01.14	RK	MK	BS	04	05.12.13	RK	SHK/MK	BS	03	16.11.13	RK	SHK/MK	BS
		PR	MD	W			--sd--	--sd--	--sd--			--sd--	--sd--	--sd--
REVISED IN LINE WITH CUSTOMER COMMENTS VIDE LETTER NO. TCE5750A-IC-540-VDT-069 DATED 03.01.2014					REVISED IN LINE WITH CUSTOMER COMMENTS VIDE LETTER NO. TCE5750A-IC-540-VDT-049 DATED 25.11.13					REVISED IN LINE WITH CUSTOMER COMMENTS VIDE LETTER NO. TCE5750A-IC-540-VDT-038 DATED 30.10.13				

REV.	DATE	ALT	CHD	APPD	CUSTOMER: RAJASTHAN RAJYA VIDYUT UTPADAN NIGAM LTD.
02	03.10.13	RK	SHK/MK	BS	
		--sd--	--sd--	--sd--	
REVISED IN LINE WITH CUSTOMER MOM BETWEEN TCE, RRVUNL AND BHEL ON DATED 12,13&14 AUG'13					CONSUTANT: TATA CONSULTING ENGINEERS LIMITED
PROJECT: 2X660 MW, SUPER-CRITICAL TPS, STAGE- V SURATGARH, RAJASTHAN					
REV.	DATE	ALT	CHD	APPD	
01	03.07.13	RK	SHK	ABS	
REVISED IN LINE WITH CUSTOMER COMMENTS VIDE LETTER NO. TCE5750A-IC-540-VDT-001 DATED 24.05.2013					
 BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA					DEPT CODE I NAME SIGN DATE
TITLE					DRIVE CONTROL PHILOSOPHY (STATION C&I)
ELEC.					DEPT. SCALE
					SIGN
					DATE
DRAWING NO. PE-DM-392-145-1002					
SHEET 1 OF 11					REV 04

	DOCUMENT TITLE DRIVE CONTROL PHILOSOPHY(STATION C&I)	DOCUMENT NUMBER	PE-DM-392-145-I002		
		REVISION NUMBER	05	DATE	14-01-2014
	PROJECT: 2X660 MW SURATGARH STPS, STAGE-V	SHEET	2	OF	11

A. DRIVE CONTROL PHILOSOPHY

The control philosophy for different type of Drives is detailed below:

1. Bidirectional drives without integral starter (Open/Close duty & inching/regulating duty)

- a) All bi-directional drives shall be operable from local (from MCC/SWGR), field (from LPBS) and remote i.e. Central Control Room (CCR). Drives shall have local push button switch (LPBS) for open, **close and emergency stop** for field operation. Selector switch with L/F/R modes will be placed at MCC.
- b) Remote manual operation of all drives shall be done from OWS.
- c) Remote control commands i.e. open/close, generated from DCS shall be issued to MCC through interposing relays located in respective MCC. Latching of command shall be provided at MCC through hard wiring. De-latching shall be done through torque and limit switches feedback. No latching shall be envisaged for inching duty bi-directional drives.
- d) **For opening/closing of drive, open/close PB shall be wired in series with field selector switch position in MCC and open/close torque switches and limit switches. Emergency stop PB shall be wired to trip circuit. EPB shall be with lockable type. Under lock position the drive operation is inhibited.**
- e) Necessary electrical protections shall be realized at MCC, whereas process interlocks and protections shall be realized in DCS. No interlocks shall be provided for local operation of the drive.
- f) Following signal exchange shall take place between MCC & DCS.
 - Valve open & close command
 - MCC power supply is isolated.
 - Control supply is healthy.
 - Overload relay operated.
 - Selector switch in remote mode.
 - Selector switch in field mode.
 - **EPB stop operated**
 - **Control supply unhealthy**
- g) Control supply healthy (NC), control supply unhealthy (NO) shall be used to find out/monitor common cable break and display in DDCMIS.
- h) Following signals will be derived at DCS from signals available at MCC:
 - MCC available (MCC power supply not isolated/ Control supply Healthy/ Overload relay not acted and Selector switch in remote mode, **EPB not pressed**).
 - MCC disturbed (MCC power supply isolated/ Control supply not Healthy/Overload relay acted and Selector switch not in remote mode, **EPB pressed**).
 - Control supply unhealthy
 - Select switch in local mode. (Selector switch not in local and remote mode)
- i) Following signal exchange shall take place from valve actuator to DCS.
 - Valve status feedback by Limit switch contact (open/close)
 - Valve status feedback by Torque switch contacts (open/close)
 - Valve position feedback (4-20 mA) for inching duty drives.
- j) Following signal exchange shall take place from valve actuator to MCC.
 - Valve status feedback by Limit and torque switch contact (open/close)
 - Thermostat contact.

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The above signal exchanges are diagrammatically represented in sheet no. 7.

2 Unidirectional LT Drives (Contactor Operated)

- a. Unidirectional LT drives shall be operable from local (MCC/SWGR), field (LPBS) and remote i.e. from Central Control Room (CCR). Drives shall have local push button switch (LPBS) for start and emergency stop for field operation. Selector switch with L/F/R modes will be placed at MCC.
- b. Remote manual operation of all drives shall be done from OWS.
- c. Remote control commands i.e. start/stop shall be generated from DCS and shall be issued to MCC through interposing relays located in respective MCC. DCS output command shall be latched in MCC. Start PB shall be wired in series with field selector switch position in MCC and stop PB shall be directly wired to trip circuit.
- d. Necessary electrical protections for the drives shall be realised at MCC, whereas process interlocks and protections shall be realized in DCS.
- e. Following signal exchange shall take place between MCC & DCS
 - i. Drive Start & Stop commands.
 - ii. Drive ON & OFF feedback.
 - iii. Selector switch in remote mode.
 - iv. Selector switch in field mode.
 - v. MCC power isolated.
 - vi. Overload relay operated.
 - vii. Control supply healthy.
- viii. EPB stop operated**
- f. Following signals will be derived at DCS from signals available at MCC:
 - MCC available (Thermal overload not operated/Control supply healthy/ MCC power not isolated, **EPB not pressed**).
 - MCC disturb (Thermal overload operated/Control supply fail/ MCC switched power isolated, Selector switch not in remote, **EPB pressed**).
 - Control supply unhealthy
 - Selector switch in local mode.
- g. Current transducers, 4-20mA types, shall be mounted in the MCC for monitoring the current in DCS for all drives ≥ 30 KW and for important drives <30 KW. Auxiliary power supply to these transducers shall be provided from the control power supply of the respective MCC.

The above signal exchanges are diagrammatically represented in sheet no. 8.

3 Solenoid Operated Drives

- a. Solenoid operated drives shall be operable from remote i.e. CCR only.
- b. Remote manual operation of all drives shall be done from OWS.
- c. Remote control commands i.e. open/close shall be generated from DCS and shall be issued to the respective solenoid through interposing relays located in Interposing Relay panels.
- d. Necessary process interlocks shall be realized in DCS.
- e. Following signal exchange shall take place between solenoid operated drive & DCS
 - i. Valve open & close command.
 - ii. Valve status feedback by means of limit switches (open/close), wherever available.

The above signal exchanges are diagrammatically represented in sh. no. 9.

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HT/LT Unidirectional Drives (Breaker operated).

- a. Remote & manual operation of Breaker operated drives shall be operable from local (MCC/SWGR), field (LPBS) and remote i.e. Station DCS through OWS.
- b. Local (switchgear)/Field (Motor LPBS)/Remote selection shall be realized from SWGR mounted L/F/R selector switch.
- c. Following are the operational combinations for breaker operated drives:
 - BREAKER IN SERVICE POSITION** – Drive Operation (Start/Stop) shall be from CCR with L/F/R (Local/Field/Remote) selector switch in Remote position or from field if L/F/R switch is in field mode.
 - BREAKER IN TEST POSITION**–SWGR Testing (Local/Field/Remote) from SWGR when L/F/R switch is in local mode and from CCR when L/F/R is in remote mode. In test position breaker shall be racked out condition.
- d. Remote control commands i.e. start (pulse type)/ stop, shall be generated from DCS and shall be issued to Switchgear through interposing relays located in respective Switchgear.
- e. The EPB shall be wired directly to switchgear. **EPB shall be lockable type. Under lock position the drive operation is inhibited.**
- f. Necessary electrical protections for the drive shall be realised at Switchgear, whereas process interlocks and protections shall be realized in DCS.
- g. The Start PB shall be wired in series with field selector switch position in SWGR and stop PB shall be directly wired to trip circuit.
- h. Following signal exchange shall take place between switchgear and DCS: -
 - i. Drive Start & Stop commands.
 - ii. Drive ON & OFF status feedback.
 - iii. Selector switch in Field mode.
 - iv. Selector switch in remote mode.
 - v. Breaker in service.
 - vi. Breaker in test.
 - vii. Control supply **unhealthy**
 - viii. Circuit side earthed.
 - ix. Trip circuit **unhealthy**.
 - x. Spring **not charged**
 - xi. Lock out relay operated/Breaker trip
 - xii. Emergency stop PB operated
 - xiii. Relay **unhealthy**
 - xiv. Relay healthy
 - xv. LBB operated feedback
- i. Relay healthy (NC), relay unhealthy (NO) shall be used to find out/monitor common cable break and display in DDCMIS.
- j. Following signals will be derived at DCS from signals available at switchgear:
 - Breaker in local mode (Not in remote, not in field)
 - Breaker trip circuit **healthy**
 - Breaker trip /Master relay operated
 - Breaker spring **charged**

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- Switchgear available(Breaker in service position, trip circuit healthy, master trip relay reset, spring charged, **control supply healthy, EPB not operated and breaker in remote**)
- Switchgear disturb (Control supply fail/Trip coil unhealthy/**Spring not charged/Lockout relay operated/Remote mode not selected**)
- Trip through process interlock
- Relay **healthy** feedback
- Control supply **healthy**

k. Current transducers, 4-20mA types (in SWGR suppliers scope), shall be mounted in the SWGR for monitoring the current in DCS. Auxiliary power supply to these transducers shall be provided from the control power supply of the respective switchgear.

The above signal exchanges are diagrammatically represented in sh. no. 10.

B. SEQUENCE CONTROL PHILOSOPHY

1.0 Sequence control is envisaged for startup and shutdown of main drives and their associated drives from OWS. The drives can be operated manually or automatically through group/sub-group control and through process interlocks.

1.1 Sequence Mode Operation

Sequence controls are organized hierarchically in accordance with the operation concept of the plant process. Accordingly following levels of sequence control exists.

- Functional group control
- Sub group control

Functional Group Control logic co-ordinates between functionally cascaded lower level sequence control logics. It performs following functions

- Mode of operation
- Sequential start/stop of sub group.

Sub Group Control performs sequence control strategies on main drive and related drives as required by the process and taking care of the healthiness of each drive e.g. BFP along with its recirculation valve, discharge valve and AOP in a sequence, will form sequence control logic for BFP.

1.2 Sequence Start Up Mode

- 1) **Automatic mode:** - In this mode of operation, once the sequence is initiated, it shall progress without involvement of the operator.
- 2) **Semi-automatic mode:** - In this mode of operation, once the sequence is initialized, the step progressing shall be displayed on the OWS. But the step execution command shall be interlocked and shall be sent by the operator via keyboard. It shall be possible to bypass and/or simulate one or more criteria to enable the program to proceed. This facility shall allow the program to be executed even if some criteria are not fulfilled. It shall be possible to put the system on the auto mode

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after operating it on semi-auto mode for some steps or vice-versa, without disturbance to the sequence operation.

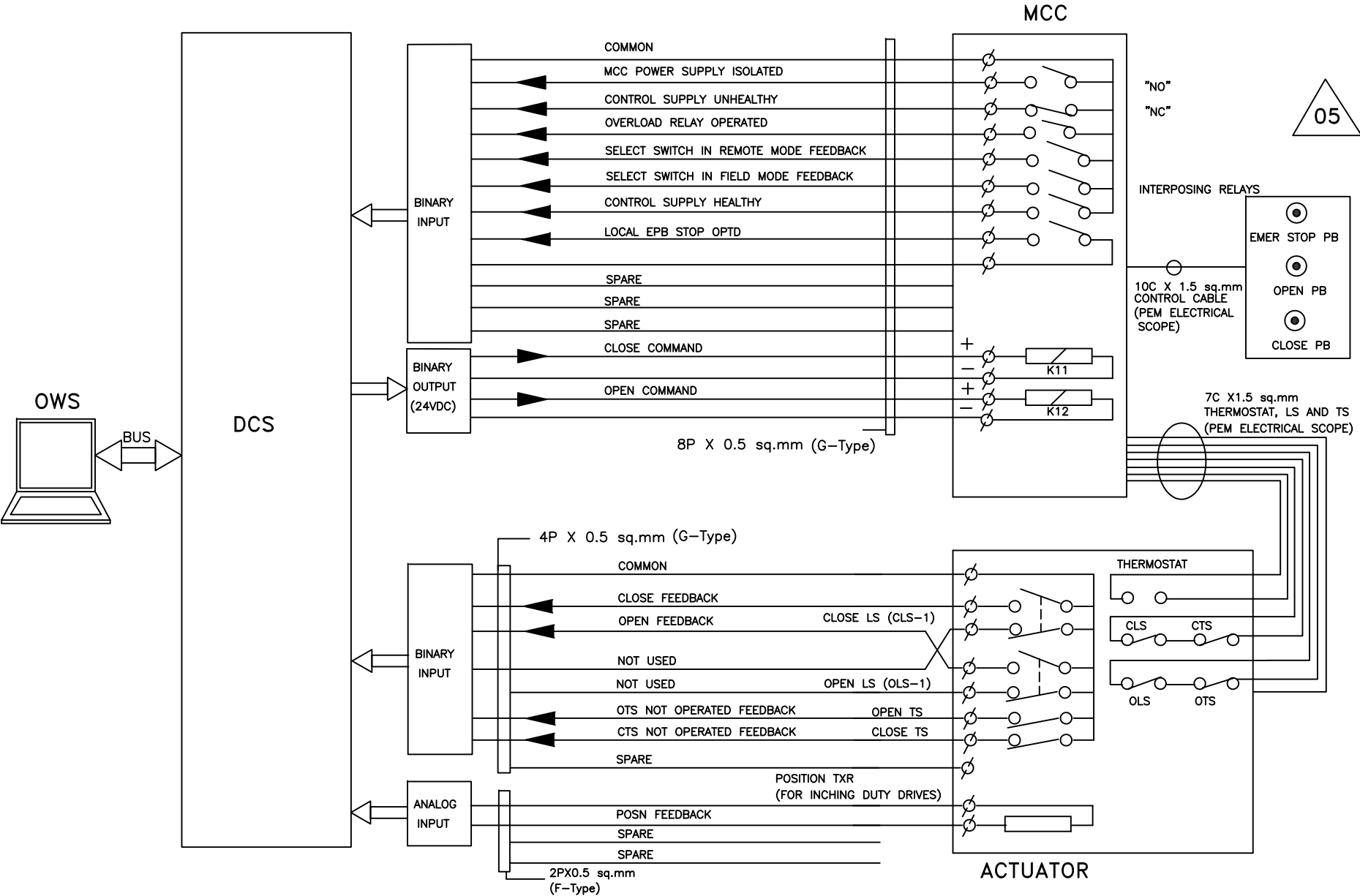
- 3) **Operator test mode:** It shall be possible to use the sequential control in operator guide mode / test mode i.e. the complete system runs and receives input from the plant OWS but its command output is blocked. The whole program, in this case shall run in manual mode. This mode shall allow practicing manual operation using step and criteria indications. The actual protection shall remain valid during this mode of operation also.

C. ANALOG CONTROL & MEASUREMENT PHILOSOPHY**1) Analog Drives Control**

- 1.1 A drive control function residing in controller is used to position the pneumatically/electrically operated control valves. Interlock and protection Open/Close Commands, originating from field or generated internally in Control Logics (ACS), are interfaced with the drive control function residing in controller.
- 1.2 Control Valve actuator design shall take care of fail safe condition i.e. bringing valve to full open/full close or stay put mode, on signal (pneumatic/electric) failure.
- 1.3 Auto/Manual operator control and display for various control loops shall be provided through OWS, using Analog Displays.
- 1.4 Analog Displays have following functionality:
- Auto/Manual selection with control device “Raise/Lower Buttons”
 - Set point indication with “Raise/Lower Buttons”
 - Indication for deviation between set point and measured value
 - Measured value indication
 - Final control element portion indicators.
 - All control valves/dampers (except for SADC/Burner tilt) shall be provided with smart positioner.

The above signal exchanges with DCS are diagrammatically represented in sh.no. 11.

DCS INTERFACE FOR BIDIRECTIONAL DRIVE(WITH MCC)

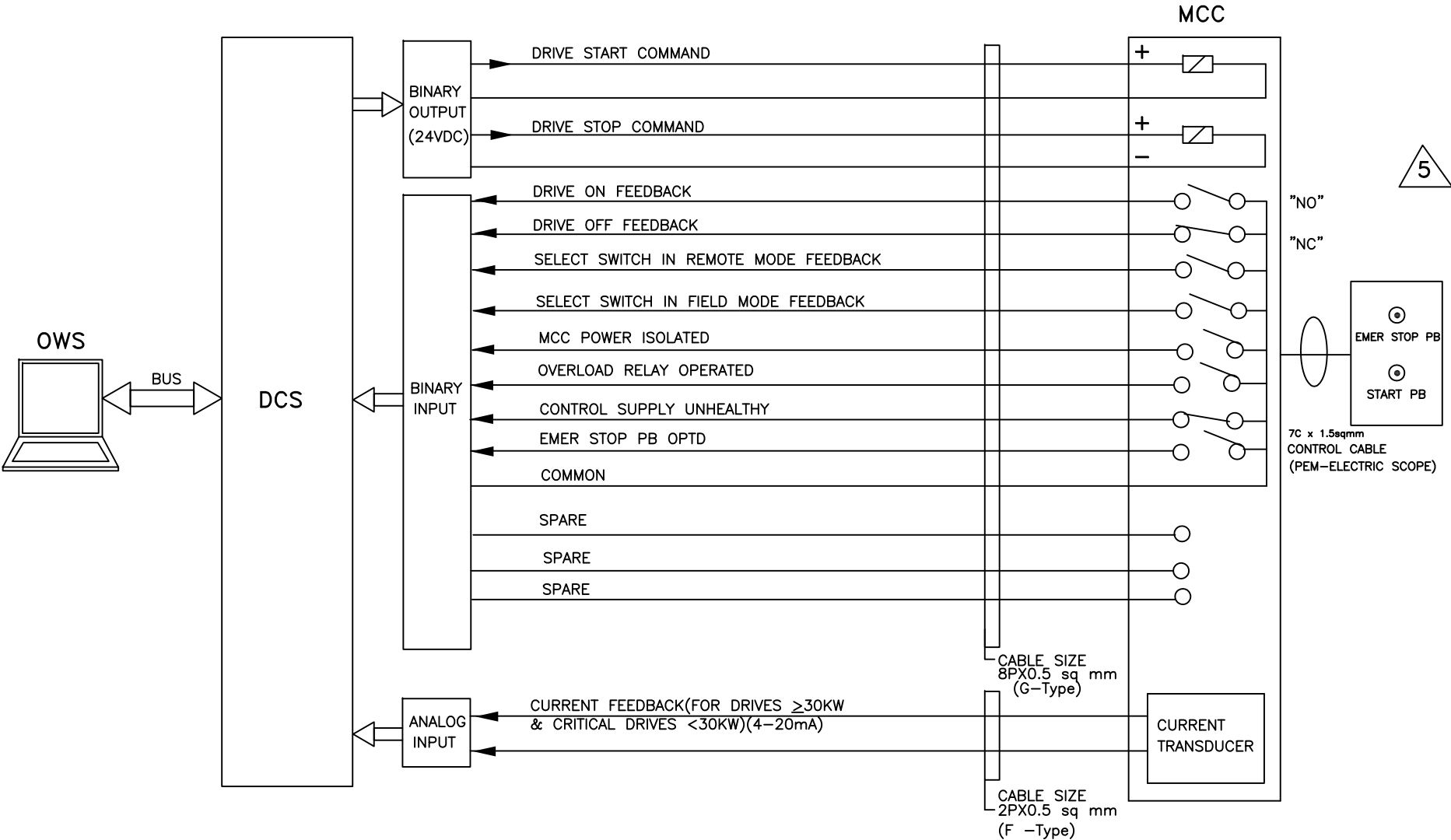


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TITLE DDCMIS INTERFACE FOR
BIDIRECTIONAL DRIVE

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DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE

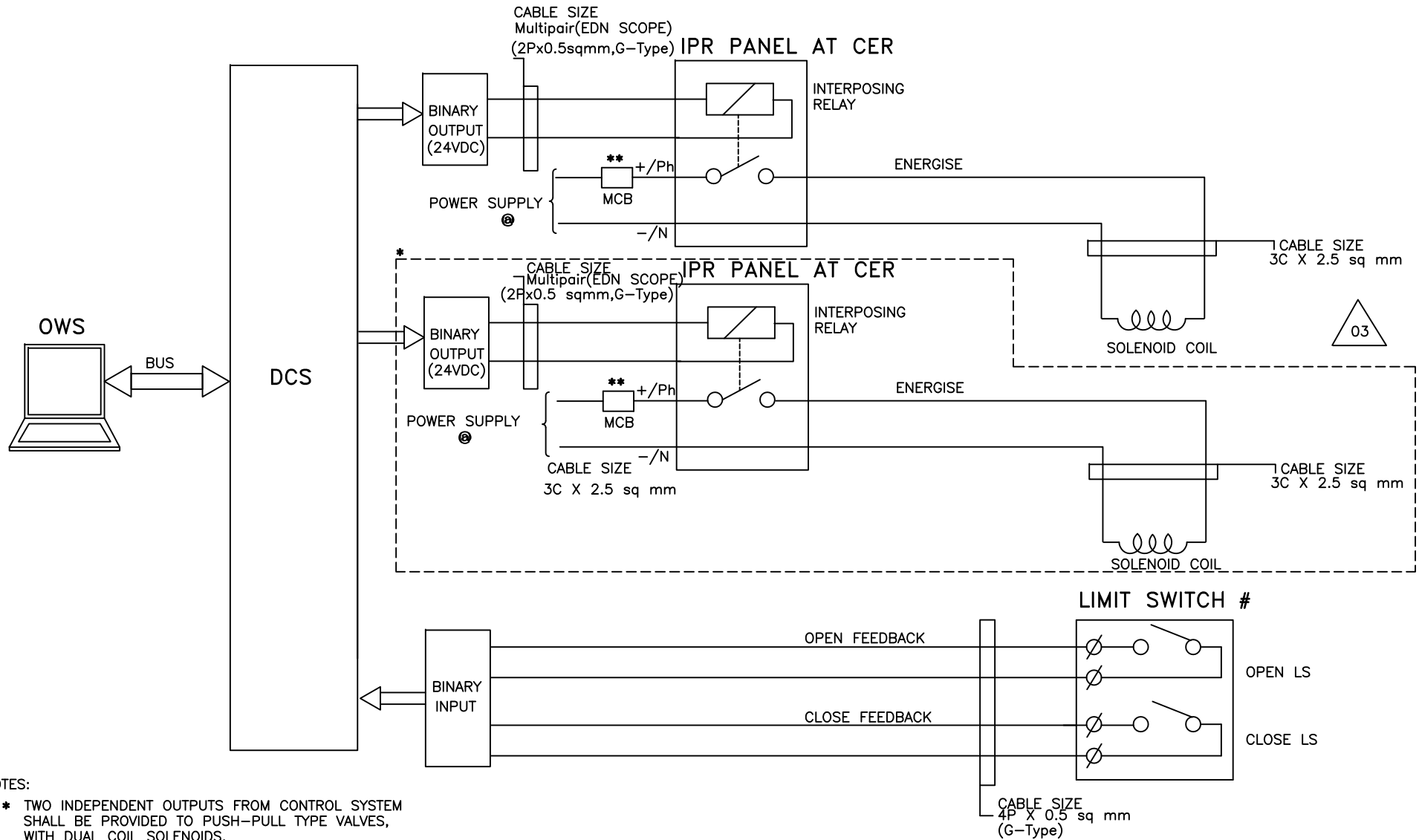


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TITLE DDCMIS INTERFACE FOR UNIDIRECTIONAL LT DRIVE

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DCS INTERFACE FOR SOLENOID DRIVE (24V DC / 240V AC UPS)



NOTES:

* TWO INDEPENDENT OUTPUTS FROM CONTROL SYSTEM SHALL BE PROVIDED TO PUSH-PULL TYPE VALVES, WITH DUAL COIL SOLENOIDS.

** MCB SHALL BE PROVIDED FOR EACH SOLENOID

FOR ON/OFF TYPE, SOLENOID ACTUATED CONTROL VALVE.

Ⓢ 24 VDC FROM DDCMIS DC SYSTEM



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DDCMIS INTERFACE FOR
SOLENOID DRIVE

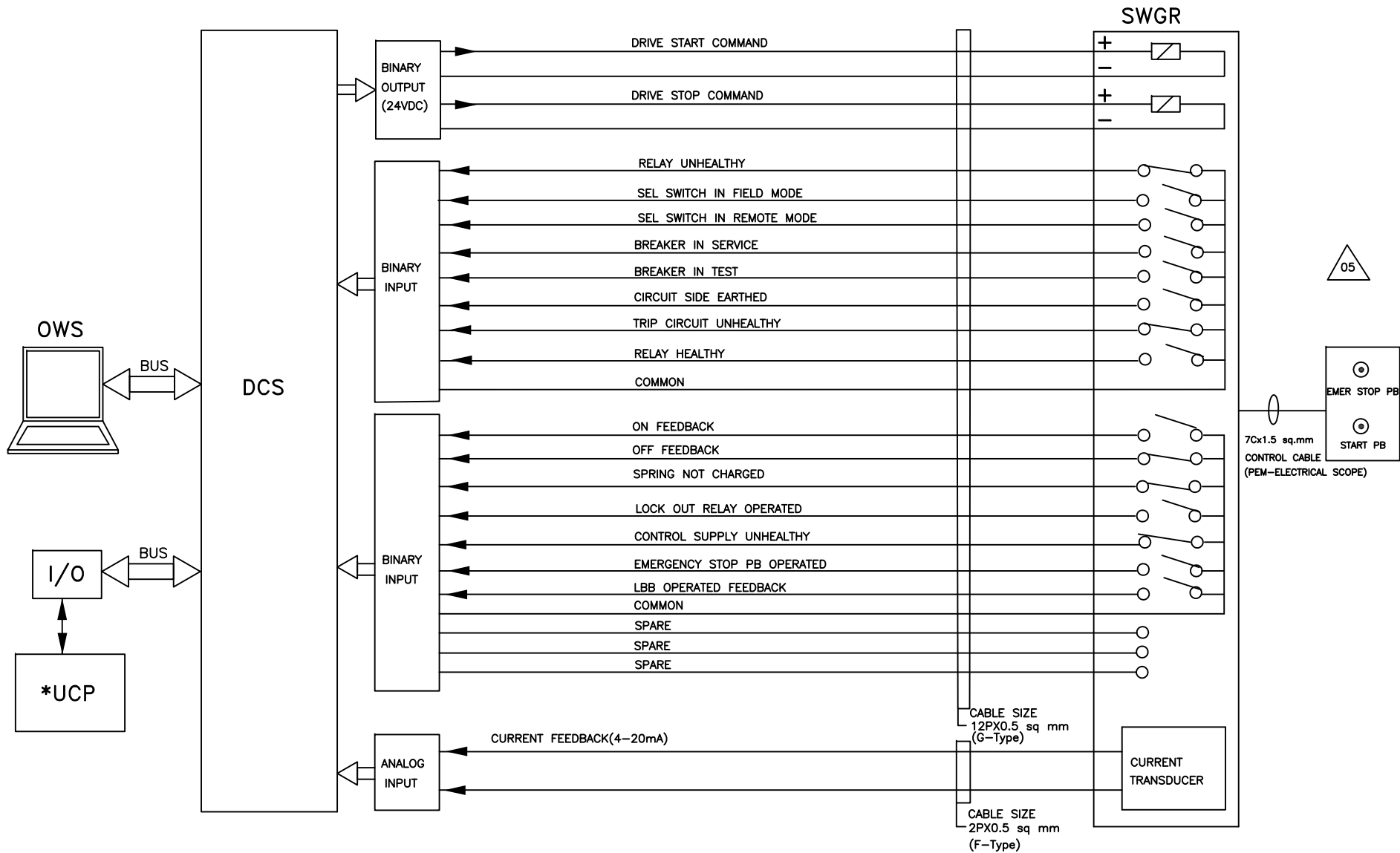
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DCS INTERFACE FOR HT/LT UNIDIRECTIONAL DRIVES(BREAKER OPERATED)



NOTE:
*WHEREVER APPLICABLE

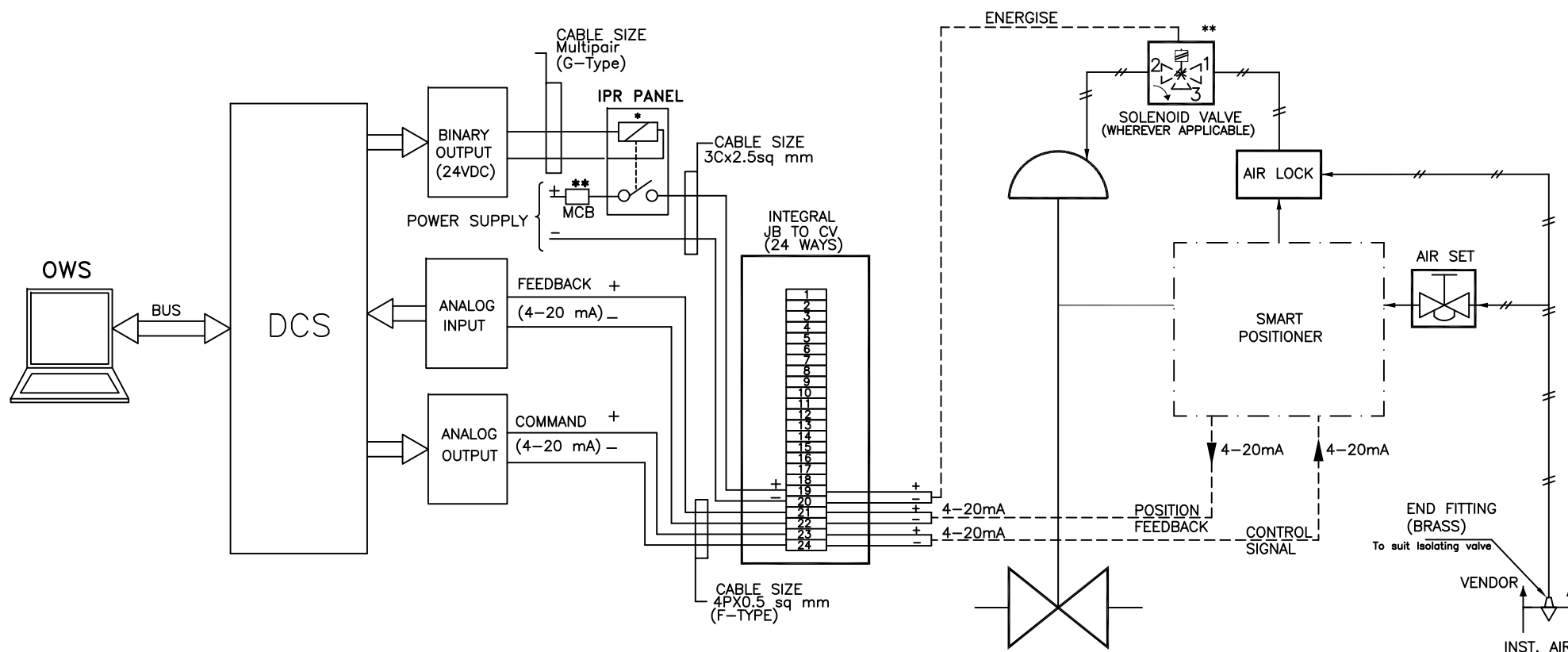


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TITLE DDCMIS INTERFACE FOR UNIDIRECTIONAL HT DRIVE

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DCS INTERFACE FOR ANALOG DRIVE (WITH SMART POSITIONER)



NOTES:

** APPLICABLE TO VALVES WHERE PROTECTION OPEN/CLOSE ACTION FOR CONTROL DEMAND OVERRIDING IS REQUIRED.



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TITLE TYPICAL HOOK-UP DIAGRAM
ANALOG DRIVE (WITH SMART POSITIONER)

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