

<div><div><div><div><div></div><div>NALCO</div></div><div><div>नेशनल एल्युमिनियम कार्पोरेशन लिमिटेड</div><div>National Aluminium Company Ltd.</div></div></div></div><div><div><div></div><div>thyssenkrupp</div></div></div></div> <td colspan="3" rowspan="4">Typical I/O list for SCADA</td> <td>Code</td> <td colspan="5">NAL</td>			Typical I/O list for SCADA			Code	NAL				
Contract No:						66-6695					
Doc ID						6695-ELT-G00-FS-0001					
Rev.						01					
Rev. No.	Sr No.	Equipment Description	I/O Service	AI	DI	DO	Type of Information	Hard/ Soft	Remarks		
	1	11kV Incomer Breaker	Circuit Breaker on		1		Status	Hard			
			Circuit Breaker off		1		Status	Hard			
			Circuit Breaker trip (86) Operated		1		Status	Hard			
01			Relay Unhealthy (Watchdog)		1		Alarm	Hard			
			Breaker Test Position		1		Status	Soft			
			Breaker Service Position		1		Status	Soft			
			Relay 51 Operated		1		Alarm	Soft			
			Relay 51N Operated		1		Alarm	Soft			
01			Relay 95 Unhealthy		1		Alarm	Hard			
			Relay 87L Operated		1		Alarm	Soft			
			Line Current R, Y & B Phase	3			Value	Soft			
			Frequency	1			Value	Soft			
			Power Factor	1			Value	Soft			
			kW	1			Value	Soft			
			kVAR	1			Value	Soft			
			kVA	1			Value	Soft			
			kVAh	1			Value	Soft			
			kWH	1			Value	Soft			
01			Close command from SCADA				1	Command	Hard		
01			Trip command from SCADA				1	Command	Hard		
01			2	11kV, 6.6kV & 0.690kV Line PT	PT MCB healthiness		1		Alarm	Hard	
					Relay 27 Operated		1		Alarm	Soft	
					Voltage R-Y, Y-B & B-R Phase	3			Value	Soft	
	3	11kV, 6.6kV & 0.690kV BUS PT	Relay 27 Operated, 20%		1		Alarm	Soft			
			Relay 27 Operated, 80%		1		Alarm	Soft			
			Relay 27Operated, 80% with time delay (2)		1		Alarm	Soft			
			Relay 59 Operated		1		Alarm	Soft			
			Relay 59 Operated with time delay (2)		1		Alarm	Soft			
01			PT MCB healthiness		1		Alarm	Hard			
			Voltage R-Y, Y-B & B-R Phase	3			Value	Soft			
	4	11kV BUS Coupler	Circuit Breaker on		1		Status	Hard			
			Circuit Breaker off		1		Status	Hard			
			Circuit Breaker trip (86) Operated		1		Status	Hard			
01			Relay Unhealthy (Watchdog)		1		Alarm	Hard			
			Auto-manual switch-Auto selected		1		Status	Soft			
			Auto-manual switch-Manual selected		1		Status	Soft			
			Trip Selector Switch-I/C-1 Selected		1		Status	Soft			
			Trip Selector Switch-I/C-2 Selected		1		Status	Soft			
			Trip Selector Switch-B/C Selected		1		Status	Soft			
			Breaker Test Position		1		Status	Soft			
			Breaker Service Position		1		Status	Soft			
			Relay 25 operated		1		Alarm	Soft			
			Relay 51 Operated		1		Alarm	Soft			
			Relay 51N Operated		1		Alarm	Soft			
01			Relay 95 Unhealthy		1		Alarm	Hard			
			Relay 80 Operated		2		Alarm	Soft			
			Line Current R, Y & B Phase	3			Value	Soft			
01			Close command from SCADA				1	Command	Hard		
01			Trip command from SCADA				1	Command	Hard		
	5	11/ 0.433 kV 11/ 6.9 kV 11/ 0.720 kV Transformer Feeder	Circuit Breaker on		1		Status	Hard			
			Circuit Breaker off		1		Status	Hard			
			Circuit Breaker trip (86) Operated		1		Status	Hard			
01			Relay Unhealthy (Watchdog)		1		Alarm	Hard			
			Breaker Test Position		1		Status	Soft			
			Breaker Service Position		1		Status	Soft			
			Relay 51 Operated		1		Alarm	Soft			
			Relay 51N Operated		1		Alarm	Soft			
			Relay 50 Operated		1		Alarm	Soft			
			Relay 50N Operated		1		Alarm	Soft			
01			Relay 95 Unhealthy		1		Alarm	Hard			
			Relay 96 Operated		1		Alarm	Soft			
			OTI Alarm		1		Alarm	Hard			
			OTI Trip		1		Alarm	Hard			
			WTI Alarm		1		Alarm	Hard			
			WTI Trip		1		Alarm	Hard			
			Buchholz Alarm		1		Alarm	Hard			
			Buchholz Trip		1		Alarm	Hard			
			Pressure Relive Device Operated		1		Alarm	Hard			
			Oil Level Gauge Alarm		1		Alarm	Hard			
			Emergency pushbutton operated		1		Status	soft			
			Line Current R, Y & B Phase	3			Value	Soft			
			Power Factor	1			Value	Soft			
			kW	1			Value	Soft			
01			Load shedding command from SCADA				1	Command	Hard		
01			Close command from SCADA				1	Command	Hard		
01			Trip command from SCADA				1	Command	Hard		

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01	6	11/ 0.380 kV Normal Lighting Transformer Feeder	Circuit Breaker on		1		Status	Hard			
			Circuit Breaker off		1		Status	Hard			
			Circuit Breaker trip (86) Operated		1		Status	Hard			
			Relay Unhealthy (Watchdog)		1		Alarm	Hard			
			Breaker Test Position		1		Status	Soft			
			Breaker Service Position		1		Status	Soft			
			Relay 51 Operated		1		Alarm	Soft			
			Relay 51N Operated		1		Alarm	Soft			
			Relay 50 Operated		1		Alarm	Soft			
			Relay 50N Operated		1		Alarm	Soft			
			Relay 95 Unhealthy		1		Alarm	Hard			
			Relay 96 Operated		1		Alarm	Soft			
			WTI Alarm		1		Alarm	Hard			
			WTI Trip		1		Alarm	Hard			
			Line Current R, Y & B Phase	3			Value	Soft			
			Power Factor	1			Value	Soft			
			kW	1			Value	Soft			
			Close command from SCADA			1	Command	Hard			
			Trip command from SCADA			1	Command	Hard			
01	7	11kV Motor Feeder	Relay Unhealthy (Watchdog)		1		Alarm	Hard			
			Breaker Test Position		1		Status	soft			
			Breaker Service Position		1		Status	soft			
01			Ready to start		1		Status	soft			
			Relay 49 Operated		1		Alarm	Soft			
			Relay 50 Operated		1		Alarm	Soft			
			Relay 50N Operated		1		Alarm	Soft			
			Relay 46 Operated		1		Alarm	Soft			
			Relay 50L/R Operated		1		Alarm	Soft			
			Relay 50G Operated		1		Alarm	Soft			
01			Relay 95 Unhealthy		1		Alarm	Hard			
			Relay 87M Operated		1		Alarm	Soft			
			Line Current R, Y & B Phase	3			Value	Soft			
			kW	1			Value	Soft			
			Power Factor	1			Value	Soft			
01			Run Hour	1			Value	Soft			
01			Load shedding command from SCADA			1	Command	Hard			
01			Trip command from SCADA			1	Command	Hard			
			8	11kV VFD Feeder	Circuit Breaker on		1		Status	Hard	
	Circuit Breaker off				1		Status	Hard			
	Circuit Breaker trip (86) Operated				1		Status	Hard			
01	Relay Unhealthy (Watchdog)				1		Status	Hard			
	Breaker Test Position				1		Status	soft			
	Breaker Service Position				1		Status	soft			
	Relay 51 Operated				1		Alarm	Soft			
	Relay 51N Operated				1		Alarm	Soft			
01	Relay 95 Unhealthy				1		Alarm	Hard			
	Line Current R, Y & B Phase	3					Value	Soft			
	Power Factor	1					Value	Soft			
	kW	1					Value	Soft			
	kWH	1					Value	Soft			
01	Load shedding command from SCADA					1	Command	Hard			
01	Close command from SCADA					1	Command	Hard			
01	Trip command from SCADA					1	Command	Hard			
01	9	11kV, 6.6kV, 690V and 415V VFD	Speed Indication	1			Value	Soft			
			Fault Code		1		Alarm	Soft			
			Motor Running feedback (either in VFD or Bypass Mode)		1		Status	Soft			
			Motor Trip (either in VFD or Bypass Mode)		1		Alarm	Soft			
			Ready to start Feedback		1		Status	Soft			
			Local / Remote Selected		1		Status	Soft			
			VFD Temperature	1			Value	Soft			
			DC Voltage	2			Value	Soft			
			Line Current R, Y & B Phase	3			Value	Soft			
			kW	1			Value	Soft			
				10	6.6kV & 0.690kV Incomer Feeder	Circuit Breaker on		1		Status	Hard
	Circuit Breaker off		1				Status	Hard			
01	Circuit Breaker trip (86) Operated		1				Status	Hard			
	Relay Unhealthy (Watchdog)		1				Status	Soft			
	Breaker Test Position		1				Status	soft			
	Breaker Service Position		1				Status	soft			
	Relay 51 Operated		1				Alarm	Soft			
	Relay 51N Operated		1				Alarm	Soft			
	Relay 51G Operated		1				Alarm	Soft			
	Relay 64R Operated		1				Alarm	Soft			
	Relay 95 Unhealthy		1				Alarm	Soft			
	Line Current R, Y & B Phase	3					Value	Soft			
	Frequency	1					Value	Soft			
	Power Factor	1					Value	Soft			
	kW	1					Value	Soft			
	kVAR	1					Value	Soft			
	kVA	1					Value	Soft			
	kVAh	1					Value	Soft			
	kWH	1					Value	Soft			

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01	11	6.6 kV, 0.690 kV & 0.415 kV BUS Coupler	Circuit Breaker on		1		Status	Hard				
			Circuit Breaker off		1		Status	Hard				
			Circuit Breaker trip (86) Operated		1		Status	Hard				
			Relay Unhealthy (Watchdog)		1		Alarm	Soft				
			Auto-manual switch-Auto selected		1		Status	Soft				
			Auto-manual switch-Manual selected		1		Status	Soft				
			Trip Selector Switch-I/C-1 Selected		1		Status	Soft				
			Trip Selector Switch-I/C-2 Selected		1		Status	Soft				
			Trip Selector Switch-B/C Selected		1		Status	Soft				
			Breaker Test Position		1		Status	Soft				
			Breaker Service Position		1		Status	Soft				
			Relay 25 operated		1		Alarm	Soft				
			Relay 51 Operated		1		Alarm	Soft				
			Relay 51N Operated		1		Alarm	Soft				
			Relay 95 Unhealthy		1		Alarm	Soft				
			Relay 80 Operated		2		Alarm	Soft				
			Line Current R, Y & B Phase	3			Value	Soft				
			01	12	6.6kV Motor Feeder	Relay Unhealthy (Watchdog)		1		Alarm	Soft	
						VCU Test Position		1		Status	Soft	
VCU Service Position		1					Status	Soft				
Ready to start		1					Status	Soft				
Relay 49 Operated		1					Alarm	Soft				
Relay 50 Operated		1					Alarm	Soft				
Relay 50N Operated		1					Alarm	Soft				
Relay 46 Operated		1					Alarm	Soft				
Relay 50L/R Operated		1					Alarm	Soft				
Relay 50G Operated		1					Alarm	Soft				
Relay 95 Unhealthy		1					Alarm	Soft				
Line Current R, Y & B Phase	3						Value	Soft				
kW	1						Value	Soft				
Power Factor	1						Value	Soft				
Run Hour	1						Value	Soft				
01	13	6.6 kV Capacitor Feeder				Circuit Breaker on		1		Status	Hard	
						Circuit Breaker off		1		Status	Hard	
						Circuit Breaker trip (86) Operated		1		Status	Hard	
						Relay Unhealthy (Watchdog)		1		Alarm	Soft	
			Breaker Test Position		1		Status	Soft				
			Breaker Service Position		1		Status	Soft				
			Relay 51 Operated		1		Alarm	Soft				
			Relay 51N Operated		1		Alarm	Soft				
			Relay 50 Operated		1		Alarm	Soft				
			Relay 50N Operated		1		Alarm	Soft				
			Relay 95 Unhealthy		1		Alarm	Soft				
			Relay 59 Operated		1		Alarm	Soft				
			Relay 60 Operated		1		Alarm	Soft				
			Line Current R, Y & B Phase	3			Value	Soft				
			kVAR	1			Value	Soft				
			01	14	6.6 kV APFC	Isolator on		1		Status	Hard	
						Isolator off		1		Status	Hard	
						Relay Unhealthy (Watchdog)		1		Alarm	Soft	
						Step 1: On		1		Alarm	Soft	
Step 2: On		1					Alarm	Soft				
Step 3: On		1					Alarm	Soft				
Step 4: On		1					Alarm	Soft				
Line Current R, Y & B Phase	3						Value	Soft				
kVAR	1						Value	Soft				
01	15	6.6 kV VFD Feeder & Power Feeder	Circuit Breaker on		1		Status	Hard				
			Circuit Breaker off		1		Status	Hard				
			Circuit Breaker trip (86) Operated		1		Status	Hard				
			Relay Unhealthy (Watchdog)		1		Status	Soft				
			Breaker Test Position		1		Status	Soft				
			Breaker Service Position		1		Status	Soft				
			Relay 50 Operated		1		Alarm	Soft				
			Relay 50N Operated		1		Alarm	Soft				
			Relay 51 Operated		1		Alarm	Soft				
			Relay 51N Operated		1		Alarm	Soft				
			Relay 95 Unhealthy		1		Alarm	Soft				
			Line Current R, Y & B Phase	3			Value	Soft				
			Power Factor	1			Value	Soft				
			kW	1			Value	Soft				
			kWH	1			Value	Soft				

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Rev. No.	Sr No.	Equipment Description	I/O Service	AI	DI	DO	Type of Information	Hard/ Soft	Remarks
01	16	0.415 kV Switchgear Incomer	Circuit Breaker on		1		Status	Hard	
			Circuit Breaker off		1		Status	Hard	
			Circuit Breaker trip (86) Operated		1		Status	Hard	
			Relay Unhealthy (Watchdog)		1		Status	Soft	
			Breaker Test Position		1		Status	Soft	
			Breaker Service Position		1		Status	Soft	
			Relay 51 Operated		1		Alarm	Soft	
			Relay 51N Operated		1		Alarm	Soft	
			Relay 51G Operated		1		Alarm	Soft	
			Relay 64R Operated		1		Alarm	Soft	
			Relay 95 Unhealthy		1		Alarm	Soft	
			Line Current R, Y & B Phase	3			Value	Soft	
			Frequency	1			Value	Soft	
			Power Factor	1			Value	Soft	
			kW	1			Value	Soft	
			kWH	1			Value	Soft	
	17	0.415 kV Line PT	PT MCB healthiness		1		Alarm	Soft	
			Relay 27 Operated		1		Alarm	Soft	
			Voltage R-Y, Y-B & B-R Phase	3			Value	Soft	
			Voltage R-N, Y-N & B-N	3			Value	Soft	
	18	0.415 kV BUS PT	Relay 27 Operated, 20%		1		Alarm	Soft	
			Relay 27 Operated, 80%		1		Alarm	Soft	
			Relay 27Operated, 80% with time delay (2)		1		Alarm	Soft	
			Relay 59 Operated		1		Alarm	Soft	
			Relay 59 Operated with time delay (2)		1		Alarm	Soft	
			PT MCB healthiness		1		Alarm	Soft	
			Voltage R-Y, Y-B & B-R Phase	3			Value	Soft	
			Voltage R-N, Y-N & B-N	3			Value	Soft	
01	19	0.415 kV Power Feeder	Circuit Breaker on		1		Status	Hard	
			Circuit Breaker off		1		Status	Hard	
			Circuit Breaker trip (86) Operated		1		Status	Hard	
			Relay Unhealthy (Watchdog)		1		Status	Soft	
			Breaker Test Position		1		Status	Soft	
			Breaker Service Position		1		Status	Soft	
			Relay 50 Operated		1		Alarm	Soft	
			Relay 50N Operated		1		Alarm	Soft	
			Relay 51 Operated		1		Alarm	Soft	
			Relay 51N Operated		1		Alarm	Soft	
			Relay 95 Unhealthy		1		Alarm	Soft	
			Line Current R, Y & B Phase	3			Value	Soft	
			Frequency	1			Value	Soft	
			Power Factor	1			Value	Soft	
			kW	1			Value	Soft	
			kWH	1			Value	Soft	
	20	LT Motor Feeder ≥30 kW < 75 kW	Line Current R, Y & B Phase	3			Value	Soft	
			kW	1			Value	Soft	
			kWH	1			Value	Soft	
01	21	LT Motor Feeder ≥75 kW	Ready to start		1		Status	soft	
01			Relay Unhealthy (Watchdog)		1		Status	Soft	
			Relay 49 Operated		1		Alarm	Soft	
			Relay 46 Operated		1		Alarm	Soft	
			Relay 50 operated		1		Alarm	Soft	
			Relay 50N operated		1		Alarm	Soft	
			Relay 50G operated		1		Alarm	Soft	
			Relay 50L/R operated		1		Alarm	Soft	
			Line Current R, Y & B Phase	3			Value	Soft	
			kW	1			Value	Soft	
			kWH	1			Value	Soft	
01			Run Hour	1			Value	Soft	
01	22	DG SET (AMF PANEL)	DG SET On /Off		1		Status	Hard	
			DG SET trip		1		Status	Hard	
			Line Current R, Y & B Phase	3			Value	Soft	
01	23	0.415 kV DG SET Incomer Feeder	Circuit Breaker on		1		Status	Hard	
			Circuit Breaker off		1		Status	Hard	
			Circuit Breaker trip (86) Operated		1		Status	Hard	
			Relay Unhealthy (Watchdog)		1		Status	Soft	
			Breaker Test Position		1		Status	Soft	
			Breaker Service Position		1		Status	Soft	
			Relay 51 Operated		1		Alarm	Soft	
			Relay 51N Operated		1		Alarm	Soft	
			Relay 51G Operated		1		Alarm	Soft	
			Relay 49 Operated		1		Alarm	Soft	
			Relay 64R Operated		1		Alarm	Soft	
			Relay 87 Operated		1		Alarm	Soft	
			Relay 95 Unhealthy		1		Alarm	Soft	
			Relay 59 Operated		1		Alarm	Soft	
			Relay 46 Operated		1		Alarm	Soft	
			Line Current R, Y & B Phase	3			Value	Soft	
			Frequency	1			Value	Soft	
			Power Factor	1			Value	Soft	
			kW	1			Value	Soft	
			kWH	1			Value	Soft	

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	24	AC UPS	UPS-1 Failure		1		Alarm	Hard			
			UPS-2 Failure		1		Alarm	Hard			
01			Load on maintenance bypass		1		Status	Hard			
01			Load on battery		1		Status	Hard			
			Low battery		1		Alarm	Hard			
01			Load Isolated		1		Alarm	Hard			
			25	Battery charger	DC- Charger-1 Fault (Common fault signal)		1		Alarm	Hard	
01	DC- Charger-2 Fault (Common fault signal)				1		Alarm	Hard			
01	Load on battery				1		Status	Hard			
	Low battery				1		Alarm	Hard			
01	Battery disconnected				1		Status	Hard			
	26	FA			FA system fault signal		1		Alarm	Hard	
			Fire alarm actuated		1		Alarm	Hard			
			27	HVAC	HVAC system failure		1		Alarm	Hard	
		Notes:									
		1	The above I/O list is preliminary & indicative. It shall be developed further based on engineering of SCADA & load shedding philosophy during detail engineering.								
		2	Detail list shall be prepared by LSTK Contractor during detail engineering based on actual project requirements.								
		3	LSTK Contractor to note that, addition of I/O's and any change in the philosophy of Hard/ Soft during detail engineering shall be complied without any time and cost implication to Owner.								