



**GENERAL TECHNICAL SPECIFICATION FOR
MICROPROCESSOR BASED FAST BUS TRANSFER SYSTEM PANEL**

Clause	OBJECTIVE	COMPL IED YES/NO
I	This specification covers the technical specification of 32 Bit Microprocessor based fast bus transfer (BTS) panel - one/two way transfer with relay parameterization device . The bus transfer system is used to provide process continuity to the loads, by transferring the bus from one source to another.	
II	QUALIFYING REQUIREMENTS & TECHNICAL REQUIREMENT	
	This specification has been divided into two parts -	
a	Qualifying requirements: These requirements are from clause no 1.1 to 1.4. These requirements are to be met and the bidder's offer would be technically evaluated only when these clauses from 1.1 to 1.4 are complied. Deviation is not acceptable. Noncompliance of these points in any form will lead to rejection of the offer.	
b	Technical requirements: This section has been divided in following parts	
	i. Technical specification of Numerical Fast Bus transfer system.	
	ii. Drawing/Documents, required at various stages of tendering & execution.	
III	BIDDER'S OFFER STRUCTURE	
	The bidder's offer should consist of following:	
	i. Compliance to qualifying requirement clauses of this specification.	
	ii. Compliance to technical requirement clauses of this specification.	
IV	The project sites covered in the enquiry are as follows: <i>(Refer variable Annexure-A attached with enquiry).</i>	
	The customer's approved vendor must quote for all the projects covered in the enquiry. Offer for selected projects are not acceptable.	
V	PERFORMANCE CERTIFICATE	
	All items shall be guaranteed by the vendor for successful operation for a period of 48 months from the date of receipt of complete lot of all items against the project.	

COPYRIGHT AND CONFIDENTIAL

The information on this document is the property of Bharat Heavy Electricals Limited
It must not be used directly or indirectly in any way detrimental to interest of Co.



COPYRIGHT AND CONFIDENTIAL

The information on this document is the property of Bharat Heavy Electricals Limited. It must not be used directly or indirectly in any way detrimental to interest of Co.

A	QUALIFYING REQUIREMENTS	COMPLI ED YES/NO
1.1 a)	SCOPE OF WORK: The scope covers design, manufacture, assembly, testing at manufacturer's work, delivery at BHEL Bhopal, commissioning & testing at site.	
b)	The completeness of scheme in all respect shall be ensured by the supplier. Any material or accessory which may not have been specifically mentioned but which is necessary or usual for satisfactory operation and maintenance or identified during scheme approval shall be furnished without any extra cost.	
1.2	Product offered against this specification should be type tested as per relevant IS/IEC. Copy of all type test reports to be submitted alongwith the offer.	
1.3	PERFORMANCE CERTIFICATE	
	a. Product offered against this specification should be proven for power plant application and vendor to submit performance certificate for successful operation for a minimum period of two years after commissioning from the date of technical bid opening.	
	b. The certificate must bear the model no. of FBTS in operation & must be issued by the end customer.	
	c. In absence of the above certificate, offer will not be considered.	
1.4	All items shall be guaranteed by the vendor for successful operation for a period of 48 months from the date of receipt of complete lot of all items against the project.	
B	TECHNICAL REQUIREMENT:	
2	MICROPROCESSOR BASED FAST BUS TRANSFER SYSTEM	
	a) The bus transfer system shall be designed to provide process continuity to the auxiliaries on the unit and station bus at all times while transferring the bus from one source to another in a fast and safe manner at following system parameters - System voltage - 3.3kV / 6.6kV / 11kV Highest system voltage - 3.6kV / 7.2kV / 12kV System frequency - 50 Hz	
	b) The BTS shall monitor and prevent permanent paralleling of two sources for not more than 10 cycles	
	c) BTS shall be such that in case of any problem in the BTS panel like BTS trouble or control supply failure, it should not affect the switchgear system. No tripping of breakers shall be initiated under such cases	
2.1	Bus Transfer System	
	a) The Bus Transfer System should be based on a platform of 32 bit processor or higher order capability with a rugged design suitable to substation requirements.	
	b) It should be type tested as per relevant and latest ANSI/IEEE/IEC/ISI standards for EMI/EMC/Contact Rating and Environmental Withstand tests and suitable for continuous operation at up to 50 Deg C ambient temperature.	
	c) It should have RS-485 port with ModBus protocol interface for communication with DAS/DDCMIS/DCS.	
	d) The system should have transfer event sequence recording with oscillography.	



COPYRIGHT AND CONFIDENTIAL

The information on this document is the property of Bharat Heavy Electricals Limited. It must not be used directly or indirectly in any way detrimental to interest of Co.

	e) Bus transfer system shall continuously process the bus voltage and drifting phase angle dynamics to determine, using second order predictive algorithm in real time, the exact time for sending command to breaker closing coil.	
	f) Response time for offered BTS system for Check Synchronizing Permissive / Block should be less than 1cycle.	
2.2	Bus Transfer Initiation The bus transfer initiation shall be classified as : - Manual transfer - Protective transfer - Auto transfer	
	a) Manual Transfer: Manual transfer shall be used for planned transfer during normal operation of the plant. This transfer shall be initiated from the front of the panel and shall be user friendly. Manual transfer shall be possible for all feasible transfer directions and transfer modes.	
	b) Protective transfer: This transfer shall be initiated automatically from Unit to Station direction or vice versa as per logic diagram for the following conditions:	
	i) Unit Transformer Winding Temperature High Trip	
	ii) Unit Transformer Oil Temperature High Trip	
	iii) Class-A Unit Trip	
	iv) Class-B Unit Trip	
	c) Auto transfer: This transfer shall be through system monitoring. The transfer shall be through initiation on observation of abnormal system parameters with respect to the setting like bus under voltage, bus under frequency or high bus df/dt etc	
2.3	Bus Transfer Mode	
	a) The bus transfer mode combination shall be fast-in phase-slow for all protective/auto transfers, i.e. the transfer mode shall be attempted on priority as fast, backed up with in phase, backed up with slow transfer.	
	b) For manual transfer, the bus transfer system should have provision to pre-select the transfer mode combination from the front panel interface.	
	c) Each mode should have independent settings for phase angle, voltages, etc	
2.3.1	Fast Transfer: The fast transfer shall be break before make type where old source breaker trips before new sources breaker closes. The transfer shall be done on the basis of comparing the phase angle between the transfer bus and the new source to be within a settable limit (20 degrees), while the bus voltage should be at least 80% of its nominal value	
2.3.2	In Phase Transfer: The in phase transfer shall be to safely transfer the bus when fast transfer is blocked. It shall be an open circuit transfer based on detecting that the old source breaker has tripped and at the first slip cycle synchronization within an acceptable band of phase angle	
2.3.3	Slow Transfer: When both the above transfers fail, slow transfer shall take place. In this mode of transfer all motor breakers shall trip. The new breaker shall close after checking that the old source breaker has tripped and the Bus voltage has reached acceptable lower value for safe transfer typically in the range of 20-30%	



COPYRIGHT AND CONFIDENTIAL

The information on this document is the property of Bharat Heavy Electricals Limited. It must not be used directly or indirectly in any way detrimental to interest of Co.

2.3.4	<p>Momentary Paralleling: In addition a momentary paralleling mode is to be provided for manual transfer by paralleling the two sources for a brief period of not more than 10 cycles. This mode of transfer is to be used only under exceptional conditions as it involves a higher fault level for the brief paralleling period that violates the fault withstand capacity of the outgoing breakers from the Unit / Station Boards</p>	
2.4	<p>System Readiness Conditions</p> <p>a) The BTS shall perform several system checks to determine the transfer system readiness. It shall not allow the transfer to be initiated if any of the system checks condition is not satisfied.</p> <p>b) The following minimum conditions shall be considered as readiness conditions. The bidder may add other conditions, if required, for safe and satisfactory operation of the system:</p>	
2.4.1	<p>BTS Selection</p> <p>a) The BTS IN/OUT selection shall be provided in the system through programmable menu / operation of a switch.</p> <p>b) The tripping and closing supply of the breakers shall be used for the respective operations by the BTS.</p> <p>c) The tripping and closing contacts of the BTS shall be connected to the switchgear circuits only when BTS is in IN condition.</p> <p>d) The provision shall be made such that, when the DC supply of the BTS is off, then BTS shall be in out condition irrespective of selection</p>	
2.4.2	<p>BTS Blocking: Following shall be minimum conditions of BTS blocking</p> <p>a) Self-test failure</p> <p>b) Breaker failure: On initiation of commands to breaker through BTS, if breaker fails to close or open then BTS shall get blocked. If old source breaker fails to trip and new source breaker closes, then to avoid paralleling, the new source breaker shall trip. If the new source breaker also fails to trip, NC tie breaker (as applicable) shall trip</p> <p>c) Transfer failure: When desired bus transfer request does not result in desired bus transfer operation, BTS shall get blocked</p> <p>d) Protective / Auto transfer: BTS shall be blocked after every protective / auto transfer operation for the operator to verify conditions under which the transfer took place</p> <p>e) Blocking Reset: Manual resetting from the BTS front panel interface</p>	
2.4.3	<p>Breaker Configuration</p> <p>a) The BTS shall continuously monitor the status of the breaker through NO and NC auxiliary contacts of the breaker.</p> <p>b) If the status of NO and NC contacts of the breaker are not consistent with each other, the breaker status error condition shall be detected and indicated and BTS shall be put into non-readiness</p>	
2.4.4	<p>Breaker In Service Position</p> <p>a) The BTS shall continuously monitor the service position of the unit incomer breaker, and tie breaker.</p> <p>b) If any of the breakers is taken out of service position, BTS shall be put into non-readiness</p>	



COPYRIGHT AND CONFIDENTIAL

The information on this document is the property of Bharat Heavy Electricals Limited. It must not be used directly or indirectly in any way detrimental to interest of Co.

2.4.5	PT's Readiness	<p>a) The BTS shall continuously monitor incomer line side PT and unit and station switchgear bus PT for its readiness contact inputs which shall include PT in service position and no PT fuse failure.</p> <p>b) On the failure of any of the above, BTS shall be put into non-readiness</p>	
2.4.6	Breaker Trip/Close Circuit Monitoring	<p>a) BTS shall continuously monitor the DC voltage across the closing and tripping command contacts for the unit/station incomer breaker and tie breaker on unit/station board.</p> <p>b) The tripping voltage of the closed breaker and closing voltage of tripped breaker shall be monitored continuously.</p> <p>c) In the event of non-compliance of any of the above, BTS shall put into non-readiness</p>	
2.4.7	Master Trip Relay Operation	<p>a) The BTS shall continuously monitor the unit/station incomer breaker and tie breaker master trip relay contact input.</p> <p>b) In the event of operation of any of the relay, BTS shall be put into non-readiness</p>	
2.4.8	New Source Voltage Healthiness	<p>a) BTS shall continuously monitor the voltage magnitude of the new source, based on the transfer direction, for under voltage and over voltage setting of PT inputs.</p> <p>b) If the new source voltage is unhealthy, BTS shall be put into non-readiness</p>	
2.5	SELF SUPERVISION AND SUPERVISION OF INTERLOCKS/SIGNALS	BTS shall have continuous supervision of main numerical relay for checking healthiness of software and hardware.	
a)		All supervised signals should be available in the main numerical relay as indication and alarm shall be generated for remote monitoring.	
b)		It shall be possible to record the healthiness / failure of above signals in the main numerical relay as disturbance record / event record with time stamping.	
c)		It shall also be possible to block the changeover if any of the signals becomes unhealthy	
2.6	Transfer Analysis	BTS shall record every transfer event, which can be uploaded to the PC for analysis	
2.7	Operator Interface	<p>a) The operator interface shall be user friendly with built in fail-safe features.</p> <p>b) The interface shall be menu base with screen and push buttons for transfer operations.</p> <p>c) It shall give all information on the screen like transfer mode, BTS IN/OUT condition, Previous transfer log, Breaker status, BTS ready/not ready, BTS Blocked/not blocked conditions with all conditions required for BTS with manual reset, BTS test IN/OUT status etc</p>	
2.8	LED Display	<p>a) The BTS shall have programmable LED target on the front panel.</p> <p>b) The following programmed indications shall be provided. These indications are the minimum requirement. The Bidder shall incorporate other required indications for the system:</p> <p style="margin-left: 40px;">i) BTS OUT</p> <p style="margin-left: 40px;">ii) BTS Ready</p> <p style="margin-left: 40px;">iii) BTS not Ready</p>	



COPYRIGHT AND CONFIDENTIAL

The information on this document is the property of Bharat Heavy Electricals Limited. It must not be used directly or indirectly in any way detrimental to interest of Co.

2.9	Computer Interface Software	
	a) The Computer Interface Software with facility of uploading the bus transfer event information to the PC shall be provided free of charge.	
	b) The software shall also provide sequence of event recording and data profiling feature and facility for online communications with BTS.	
2.9.1	External Alarm Circuit For external alarm for BTS trouble, NO contact shall be wired up to the terminal block.	
2.10	Enclosure	
2.10.1	The enclosure shall be free standing type and shall be fabricated from rigid welded structure frame completely covered by cold rolled sheet metal enclosure of minimum thickness 3mm. The bottom plate and removable gland plate shall be minimum 2.5mm thick. The cable entry shall be from bottom.	
2.10.2	Project specific panel's dimension, earth bar details etc. shall be confirmed during drawings approval stage. However general guideline are as under -	
	a) The panel dimensions would be 2355 (H) X 800(W) X 800 (D) mm.	
	b) The enclosure shall be 19" rack type; dust and vermin proof confirming to IP-42. Gaskets shall be used between adjacent units and underneath all covers for dust proof panel.	
	c) The enclosure shall be supplied with suitably drilled foundation base frame and anti-vibration pads and anchor bolts for mounting.	
	d) Transparent front door of toughened glass / poly fiber shall be provided for visualizing the parameters without opening the door.	
2.10.3	Dimensions, wire size, earth bar size, paint shade and other details of BTS panels should match with switchgear panels being supplied for the project.	
2.10.4	All fitments in BTS panels shall be as per customer approved vendor list which shall be furnished during order execution stage.	
2.10.5	Vendor shall furnish Quality Plan of BTS panel for approval by customer.	
2.11	Secondary Wiring	
	a) All components of the BTS shall be completely wired up to the terminal block to facilitate external cable connection.	
	b) Wiring shall be complete in all respect to ensure proper functioning of control, protection, interlocking, and annunciation scheme. All spare contacts shall be wired up to terminal block.	
	c) 650V grade, single core, flexible, heat resistant, PVC insulated stranded copper conductor shall be used for switchboard wiring. Size of wiring shall be 1.5mm ² for voltage and control circuit. Number of strands per conductor for secondary wiring shall not be less than 25.	
	c) All wires shall be suitably grouped and neatly arranged with each bunch adequately supported along its run to prevent sagging. Suitable wiring trenches and channels shall be used for this purpose. Not more than two wires shall be connected to any terminal.	
	d) All wiring shall confirm to color code in accordance with the following:	
	Red : First phase connection in voltage circuit	
	Yellow: Second phase connection in voltage circuit	
	Blue : Third phase connection in voltage circuit	
	Green : Connection to earth	



COPYRIGHT AND CONFIDENTIAL

The information on this document is the property of Bharat Heavy Electricals Limited. It must not be used directly or indirectly in any way detrimental to interest of Co.

	Grey : Connection to DC circuit	
	Black :AC neutral connection, AC connections other than those specified above	
f)	Mimic diagram on the BTS Relay Panel to be provided for the breakers indication (if required by the end customer).	
g)	Required number of switches/lamps/hardware/software or connectors for Bus Transfer System as per project specific requirement to be provided (based on comments at actual project specific schematic drawings approval by BHEL/end customer) during detailed engineering stage.	
2.12	Terminal Blocks	
	a) Terminal block of secondary wiring shall be of one-piece moulded construction with stud type terminals. Insulating barriers of adequate height and thickness shall be provided between adjacent pair of terminals to provide adequate protection to the terminals and allowing easy access to the same.	
	b) Terminal block shall be of 650V grade and terminal shall be rated for 10Amp.	
	c) Terminal block shall have separate terminals for incoming and outgoing terminations. Termination for PT secondary circuits shall be provided with test links and isolating facility.	
	d) Terminal block shall be grouped according to circuit function and shall have 20% spare terminals uniformly distributed throughout the terminal block.	
	e) Separate terminal block of adequate rating shall be provided for terminating AC and DC auxiliary power supply. Terminal block shall be adequately shrouded.	
2.13	Interior Illumination	
	a) BTS panel shall have built in illumination facility. Intensity of illumination shall be adequate enough to attend fault without any external aid.	
	b) The cubicle shall also be provided with a protected socket strip with incoming switch with outgoing three pin plug connected to single phase AC supply in the panel for connection of hand lamp and any other appliance/portable equipment.	
2.14	Anti-Condensation Heaters	
	a) Panel shall be equipped for space heater suitable for 1-phase AC, 75 watts, to prevent moisture condensation within the enclosure and shall be complete with switch fuse unit / MCB of adequate rating for power supply. They shall be located inside the cubicle and suitably shrouded not to cause injury to operating personnel or damage to equipment.	
	b) The space heaters shall be controlled through a thermostat of adjustable setting to maintain cubicle temperature 50C above the ambient. The thermostat shall be preferably located in the rear portion of the control panel.	



COPYRIGHT AND CONFIDENTIAL

The information on this document is the property of Bharat Heavy Electricals Limited. It must not be used directly or indirectly in any way detrimental to interest of Co.

2.15	Labeling	
	a) Panel shall be provided with designation nameplate, fixed at the top. The size of the plate and size of the letters shall be such that it shall be visible easily.	
	b) All components of the panel whether mounted inside or on the surface shall have identifying labels, related to identifying reference of arrangement drawing and wiring diagram. The labels shall be mounted on the side or below the respective element from inside and outside of the panel.	
	c) All external labels shall be made of Aluminum anodized or non-hygroscopic, non-deteriorating material of matt or semi matt finish. External Labels shall have white lettering on black background. The thickness of metal labels shall be minimum 1mm and that of other material 1.6 mms. Internal Labels may be of Aluminium anodized / laminated paper, self-adhesive type.	
	d) For secondary fuses, current rating shall be indicated on the labels.	
	e) Special warning tag shall be provided inside and outside the panel wherever considered necessary. Warning labels shall have white letters on red background. The labels shall be securely fixed on the surface by the screws.	
	f) All labels and their inscription and BTS designation plate shall be subjected to owner's approval during drawing approval stage.	
2.16	AUXILIARY DC SUPPLY – AUTOMATIC CHANGEOVER :	
	a) Two nos. auxiliary DC supplies shall be made available to vendor. Vendor to keep provision of automatic changeover of DC supply in BTS panel to ensure uninterrupted DC supply to the system.	
2.17	Signals from BTS to DCS & from DCS to BTS :	
	2.17.1 Following minimum signals are envisaged from BTS to DCS (Binary outputs)-	
	a) BTS "ON" b) BTS "OFF" c) BTS READY d) MANUAL TRANSFER OPTD. e) BTS NOT READY f) DC SUPPLY FAIL	
	2.17.2 Following minimum signals are envisaged from DCS to BTS (Binary inputs)-	
	a) BTS "IN", b) BTS "OUT" c) BTS ALARM RESET d) MANUAL TRANSFER INITIATION e) BLOCKING UNIT TO STATION TRANSFER f) BLOCKING RESIDUAL TRANSFER g) BLOCKING STATION TO UNIT TRANSFER	
3.0	DRAWING/DOCUMENTS TO BE FURNISHED:	
3.1	2-sets of following documents with order acknowledgement :	
	a) Technical Leaflet/manual of numerical BTS.	
	b) Performance Certificate as per Clause 1.3	



COPYRIGHT AND CONFIDENTIAL

The information on this document is the property of Bharat Heavy Electricals Limited. It must not be used directly or indirectly in any way detrimental to interest of Co.

3.2	4-sets of following documents during detail engg. after PO placement for approval and distribution :	
	a) Panel general arrangement drawing showing space requirement and cable entry points	
	b) Cross sectional view of panel	
	c) Front Facia of numerical BTS module	
	d) Single line diagram	
	e) Control schematic diagram	
	f) Terminal block connections for interfacing	
	g) Bill of material	
	h) Quality assurance plan	
	i) Factory acceptance test	
	j) Site acceptance test	
	k) 2 sets of type test reports against each project for approval/review by customer. In case any discrepancy or inadequacy is found by the customer in type test reports, the same shall be resolved by supplier with customer with no binding on BHEL and without any price implication.	
3.3	6-sets of following documents along with the supplies :	
	a) Erection commissioning and instruction manual	
	b) As built drawing	
	c) Soft copy of as built drawing(CD's)	
4.0	Earthing	
	All metal parts other than those, forming part of electrical circuit shall be connected to Earth bus provided at the bottom and extended throughout the length of the panel. Earth bus conductor shall have sufficient cross section to carry short time fault current of associated circuit without any deformation. Suitable conductor shall be provided at two extreme ends for connection to plant earth bus	
5.0	Routine Test	
	a) The Bidder shall completely assemble; with all its associated equipment including bought out items, mounted, wired and test BTS panels as per relevant standard and approved FAT.	
	b) All routine tests as per approved QAP & FAT shall be carried out on panels in presence of Owner's representative	
6.0	Testing And Commissioning at site : As per the commissioning program of the unit / station switchgear, testing & commissioning work shall be carried out by the Bidder to the satisfaction of the customer without any ceiling on number of visits & number of man days per visit. The scope of work includes:	
	a) Testing, Commissioning and trial operation of the BTS with all equipments, accessories, men and materials required to carry out the work	
	b) Commissioning of BTS panel both in COLD and HOT trial	
	c) Operation under simulated service condition to ensure accuracy of wiring, correctness of control scheme and proper functioning of the equipment under all fault conditions	
	d) Any other tests not listed above but essential for the work, shall be included by the Bidder	



COPYRIGHT AND CONFIDENTIAL

The information on this document is the property of Bharat Heavy Electricals Limited. It must not be used directly or indirectly in any way detrimental to interest of Co.

7.0	Test Certificate			
	a) The vendor shall confirm that all offered fitments are type tested as per the latest edition of relevant National / International standards.			
	b) All tests at site shall be performed in presence of owner's representative.			
	c) Certified test report of all the tests carried out at the site shall be furnished for approval of the owner.			
	d) A joint MOM regarding successful commissioning of all the BTS at site shall also be prepared & signed by the Bidder's representative and BHEL/Customer Engineers.			
8.0	SITE CONDITION :			
8.1	Ambient Temp (min/max/design) deg C	:	- 5°C (min) & 50°C (max.)	
8.2	Humidity (%)	:	10% (min) & 95%(max)	
8.3	Altitude (mtr)	:	≤ 1000 meters	
8.4	Atmospheric condition : Heavily polluted (with coal dust & Fly ash) & Highly corrosive environment			
8.5	Installation	:	Indoor	
9.0	POWER SUPPLIES TO BE PROVIDED BY THE OWNER :			
		**Voltage	System	Voltage variation
	AC supply	240 VAC	1 PH	± 10%
	DC supply	220 VDC	2 Wire	-15% to +10%
	Any other supply, if required in BTS scheme, shall be arranged by the vendor by providing necessary conversion equipment.			
	** Project specific power supply details shall be confirmed during drawing approval stage.			
10.0	COLOUR SHADE :			
	The panels shall be powder coated with 60 microns minimum thickness with colour shades, to be confirmed during ordering.			
11.0	MODE OF TRANSFER OF LOAD :			
	As per project specific customer's approved SLD & logic, will be furnished at order execution stage.			
12.0	RELAY PARAMETERIZATION DEVICE :			
12.1	Laptop PC for each project shall be supplied preloaded with operating software, relay parameterization software, disturbance analysis software and any other software necessary for successful operation of the relays. Following function shall be made available on Relay parameterization equipment (Laptop PC)			
	<ul style="list-style-type: none"> • Multiple Window based display parameters • Downloading of events and disturbance records • Analysis of disturbance records • Event handling • Generation and printing of Reports • Relay parameterization thru front port of relay & through data concentrator. 			
12.2	Equipment shall be loaded with the software to achieve above function. Software CD shall be supplied for future re-loading.			
12.3	Equipment shall be of latest, upgradeable and proven one with latest processor available in the market			
12.4	Equipment shall have 15" color LCD screen, hard drive of min. 80GB memory, 1GB RAM & internal high speed modem.			



COPYRIGHT AND CONFIDENTIAL

The information on this document is the property of Bharat Heavy Electricals Limited. It must not be used directly or indirectly in any way detrimental to interest of Co.

12.5	Equipment shall be supplied complete with following accessories: <ul style="list-style-type: none">• carrying case,• 240VAC adaptor,• 1 no USB drive of min. 1GB memory or latest• Communication cord with port converter (if required) for relay communication.• DVD R/W multi drive	
12.6	Equipment shall have port for the following devices: <ul style="list-style-type: none">• Keyboard, mouse,• Parallel, Serial,• External Monitor, MIC in, Headphone out,• AC power,• USB (min. 3 nos), RJ-11, RJ-45 and IEEE 1394.	
12.7	Equipment shall be pre-loaded with the Licensed latest Windows Operating system & Licensed Windows OS/Recovery CDs for the same shall be supplied with laptop.	
12.8	Equipment should have dual monitor support i.e. display on the laptop screen and on a digital projector (if connected) screen simultaneously.	
12.9	Equipment shall have plug and play built-in speakers & internet connectivity	
12.10	One no. per project, front port communication cable of appropriate length with connector shall be provided suitable for the port of relay offered. Also corresponding suitable port in laptop shall be provided.	

- Any other interface required apart from above list may be asked during execution.



SWITCHGEAR ENGINEERING DIVISION

FBTS_REV.00

PAGE 1 OF 1

The information on this document is the property of Bharat Heavy Electricals Limited. It must not be used directly or indirectly in any way detrimental to interest of Co.

COPYRIGHT AND CONFIDENTIAL

13.0		INTERFACE DETAILS:		
Typical interface details from switchgear to BTS shall be as under. However, project specific customer's approved schematic drawings shall be furnished during execution stage -				
S. No.	Device Ref.	Device Name	Contact	Terminal Nos. from switchgear
Unit Incomer Breaker	86	Lockout Relay	1 NC	TB1-74, 75
	52a	Breaker Aux. Switch	1 NO	TB1-72, 73
	52b	Breaker Aux. Switch	1 NC	TB1-70, 71
	75S	Breaker in Service Position.	1 NO	TB1-68, 69
	Trip	BTS Trip Command	1 NO (from BTS)	TB1-66, 67
	Close	BTS Close Command	1 NO (from BTS)	TB1-64, 65
Unit Incomer Line PT	110V Line PT Input Phase R&Y	PT Input	2 Core	TB1-75 (R-Phase) TB1-74 (Y-Phase) TB1-73 (B-Phase) TB1-72 (Neutral)
	98	PT Fuse Failure	1NC (To open on Fuse Failure)	TB1-70, 71
	75S	PT in Service Position.	1 NO	TB1-68, 69
Unit Tie Breaker	86	Lockout Relay	1 NC	TB1-74, 75
	52a	Breaker Aux. Switch	1 NO	TB1-72, 73
	52b	Breaker Aux. Switch	1 NC	TB1-70, 71
	75S	Breaker in Service Position.	1 NO	TB1-68, 69
	Trip	BTS Trip Command	1 NO (from BTS)	TB1-66, 67
	Close	BTS Close Command	1 NO (from BTS)	TB1-64, 65
UNIT TIE LINE PT	110V Line PT Input Phase R&Y	PT Input	2 Core	TB1-75 (R-Phase) TB1-74 (Y-Phase) TB1-73 (B-Phase) TB1-72 (Neutral)
	98	PT Fuse Failure	1NC (open on Fuse Failure)	TB1-70, 71
	75S	Line PT in Service Position.	1 NO	TB1-68, 69
Station Tie Breaker	52a	Breaker Aux. Switch	1 NO	TB1-74, 75
	Trip	BTS Trip Command	1 NO (from BTS)	TB1-72, 73
Unit Bus PT	Bus PT on Unit Bus 110V, Phase R Y	PT Input	2 Core	TB1-75 (R-Phase) TB1-74 (Y-Phase) TB1-73 (B-Phase) TB1-72 (Neutral)
	98	PT Fuse Failure	1NC (open on Fuse Failure)	TB1-70, 71
	75S	Bus PT in Service Position.	1 NO	TB1-68, 69
Unit Bus Motor Feeders	Unit Bus Motor Trip Command	Motor Trip Contact for Tripping Each Motor on Unit Board	1 NO for Each Motor	TB1-74, 75
Protective Transfer Inputs	Unit Trip	Unit Lockout Relay	1 NO	