SUGGESTED SPECIFICATION

For

Medium Voltage

Automatic Closed Transition Transfer Switches

Specification writer please note: This system will momentarily connect the emergency generator to the utility during transfer. This usually necessitates obtaining approval from the utility company. The generator set must be equipped with an isochronous governor capable of maintaining frequency within 0.2 Hz of nominal.

Division 26 - Electrical

PART 1 GENERAL

1.01 Scope

A. Furnish and install closed transition transfer switches (CTTS) with number of poles, amperage, voltage, withstand and close-on ratings as shown on the plans. Each CTTS shall consist of Medium voltage (5 kV through 15 kV) freestanding metal-clad switchgear with vacuum circuit breakers and a microprocessor controller to provide automatic operation. All transfer switches and controllers shall be the products of the same manufacturer.

B. The CTTS shall transfer the load without interruption (closed transition) by momentarily connecting both sources of power only when both sources are present and acceptable. The maximum interconnection time is 100 milliseconds. The CTTS shall operate as a conventional break-before-make (open transition) switch when the power source serving the load fails.

1.02 Codes and Standards

The closed transition transfer switches and controls shall conform to the requirements of:

A. UL 1008A – Standard for Medium Voltage Transfer Switches, 1st Edition, for transfer switches rated greater than 750 volts up to 46 kV.

B. ANSI/IEEE C37.20.2 – Standard for Metal-Clad Switchgear.

C. ANSI/IEEE C37.04 – Standard Rating Structure for AC High-Voltage Circuit Breakers.

D. ANSI/IEEE C37.06 – Standard for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis – Preferred Ratings an Related Required Capabilities for Voltages Above 1000V.

E. ANSI/IEEE C37.11 – Standard Requirements for electrical control for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis or a total current basis.

F. ANSI/IEEE C37.09 – Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis.

G. ANSI Z55.1 – Gray Finishes for Industrial Apparatus and Equipment.

H. ANSI/IEEE C57.13 – Standard Requirements for Instrument Transformers.

I. NEMA SG4 – Alternating Current High Voltage Circuit Breakers.

J. NEMA SG5 – Power Switchgear Assemblies.

K. IEEE C37.100.1 – Standard of Common Requirements for High Voltage Power Switchgear Rated Above 1000 V.

L. NFPA 99 - Essential Electrical Systems for Health Care Facilities.

M. NFPA 110 - Emergency and Standby Power Systems.

N. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.

O. NEMA Standard ICS10 (formerly ICS2-447) – AC Automatic Transfer Switches.

P. UL 508 Industrial Control Equipment.

1.03 Acceptable Manufacturers

A. Closed Transition transfer switches shall be ASCO 7000 Series. Any alternate shall be submitted for approval to the consulting engineer at least 10 days prior to bid. Alternate bids must list any deviations from this specification.

B. The metal-clad switchgear and circuit breaker shall be manufactured by Square D, Siemens or an approved equal.

1.04 Warranty

ASCO product is warranted to be free of defects in material and workmanship for a period of eighteen (18) months from date of shipment from ASCO provided that the product has been stored in a suitable environment prior to installation. The product shipment date will be determined only from the ASCO bill of lading. If any part or portion of the ASCO product fails to conform to the Warranty within the Warranty period, ASCO, at its option, will furnish new or factory remanufactured products for repair or replacement of that portion or part.

1.05 Extra Materials/Accessories

A. Submit [one] [___] racking handle(s)* per Medium Voltage CTTS line-up. Charging handle to be furnished on each breaker mechanism.
** Any additional racking handles shall be specified.*

B. [Provide [one] [___] circuit breaker lifting device.]

C. Following are Recommended Spare Parts for Medium Voltage CTTS up to 5 kV.

ASCO Part No.	**Qty.**	**Description**
A500T2E1	3	Shawmut, Fuse Type A500T 2 Amp, 5KV

942095	3	ABB, Control Relay, 2NO/2NC, 48-130V, 50/60Hz Coil, 600VAC, 10A Cont., 7200VA Make, 720VA Break, ABB Type NF22E-12
483763	1	ASCO Harness GRP1/5 Y-Adapter
601800-002	1	ASCO Group 5 Control Panel
601799	1	ASCO, Dual Operator Control (DOC)
203987-010	3	Bussman, Fuse Type KTK 1 Amp, 600V
203987-015	3	Bussman, Fuse Type KTK 6 Amp, 600V
985449	1	Chint, Circuit Breaker, 2P, 10A, 125VDC
255102	3	Deltrol Controls, Relay DPDT 24VDC Coil
658-403-1	3	Electro Switch Green LED's for Circuit Breaker Control Switch
658-402-1	3	Electro Switch Red LED's for Circuit Breaker Control Switch
658-401-1	3	Electro Switch Yellow LED's for Circuit Breaker Control Switch
707016-007-A	3	IDEC, PL Green LED, 16mm, 24VAC/VDC Pilot Light
707016-006-A	3	IDEC, PL Red LED, 16mm, 24VAC/VDC Pilot Light
PK61SP	2	Square D Spray Paint, ANSI 61
410120VAC	1	Timemark Corp., Capacitor Trip Device, Auto Charge, 120VAC 60Hz Input, 380VDC Min. Output

D. Following are Recommended Spare Parts for Medium Voltage CTTS up to 15 kV.

ASCO Part No.	**Qty.**	**Description**
15.5CAVH1E	3	Bussman, Fuse Type CAV 1 Amp, 15.5KV
942095	3	ABB, Control Relay, 2NO/2NC, 48-130V, 50/60Hz Coil, 600VAC, 10A Cont., 7200VA Make, 720VA Break, ABB Type NF22E-12
483763	1	ASCO Harness GRP1/5 Y-Adapter
601800-002	1	ASCO Group 5 Control Panel
601799	1	ASCO, Dual Operator Control (DOC)
203987-010	3	Bussman, Fuse Type KTK 1 Amp, 600V
203987-015	3	Bussman, Fuse Type KTK 6 Amp, 600V
985449	1	Chint, Circuit Breaker, 2P, 10A, 125VDC
255102	3	Deltrol Controls, Relay DPDT 24VDC Coil
658-403-1	3	Electro Switch Green LED's for Circuit Breaker Control Switch
658-402-1	3	Electro Switch Red LED's for Circuit Breaker Control Switch
658-401-1	3	Electro Switch Yellow LED's for Circuit Breaker Control Switch
707016-007-A	3	IDEC, PL Green LED, 16mm, 24VAC/VDC Pilot Light
707016-006-A	3	IDEC, PL Red LED, 16mm, 24VAC/VDC Pilot Light
PK61SP	2	Square D Spray Paint, ANSI 61

410120VAC	1	Timemark Corp., Capacitor Trip Device, Auto Charge, 120VAC 60Hz Input, 380VDC Min. Output

PART 2 PRODUCTS

2.01 Metal-Clad Switchgear Assembly

A. The metal-clad switchgear shall consist of a [Type 1 Indoor] [Type 3R Outdoor Non-Walk-In] enclosure containing circuit breakers and the necessary accessory components all factory assembled (except for necessary shipping splits) and operationally checked. The assembly shall be a self-supporting and floor mounted on a level concrete pad. The integrated switchgear assembly shall withstand the effects of closing, carrying and interrupting currents up to the assigned maximum short circuit rating.

B. System Voltage: [___] kV nominal, three-phase [grounded**][ungrounded], [50] [60] Hz.

C. Maximum Design Voltage: [4.76] [15.0] kV.

D. Impulse Withstand (Basic Impulse Level): [60] [95] kV.

E. Power Frequency Withstand: [19] [36] kV, 1 minute test.

F. Main Bus Ampacity: [1200] [2000] [3000] amps, continuous.

G. Momentary Current Ratings: Equal to the circuit breaker close and latch rating, [[25] [40] kAIC @ 5 kV] [[40] [50] kAIC @ 15 kV].

***Specifier to insert description, either "solidly grounded" or a specific type of impedance grounding. NOTE: This will be important when specifying Surge Arresters.*

2.02 Components

A. Stationary Structure

1. The switchgear shall comprise a minimum of [two (for 1200A)] [three (for 2000/3000A)] sections including one breaker compartment and one auxiliary compartment with potential assemblies for Normal and Emergency sources assembled to form a rigid self-supporting completely enclosed structures providing steel barriers between sections.

2. The [first (for 1200A)] [first and third (for 2000A)] [first and third (for 3000A)] section(s) is/are divided by metal barriers into the following compartments: [(a.) Circuit breaker, main bus and cable. The section may have up to two circuit breaker compartments for a 1200 ampere rating] [(a.) Circuit breaker, one set of transformer assembly, main bus and cable. The section may have up to one circuit breaker compartment and one set of potential transformer assembly compartment for a 2000 ampere rating] [(a.) Circuit breaker, main bus and cable. The section may have up to one circuit breaker compartment for a 3000 ampere rating].

3. The [second (for 1200A/2000A/3000A)] section is divided by metal barriers into

the following compartments: [(a.) Two sets of potential transformer assembly, load bus and cable. The section may have up to two sets of potential transformer assembly compartments for a [1200] [3000] ampere rating] [(a.) Load bus and cable. The section is for a 2000 ampere rating].

B. Circuit Breaker Compartment

1. Each circuit breaker compartment shall be designed to house a horizontal drawout metal-clad vacuum circuit breaker. The stationary primary disconnecting contacts are to be silver-plated copper and mounted within glass polyester support bushings. The movable contacts and springs shall be mounted on the circuit breaker element for ease of inspection/maintenance.

2. Entrance to the stationary primary disconnecting contacts shall be automatically covered by metal shutters when the circuit breaker is withdrawn from the connected position to the test or disconnected position or removed from the circuit breaker compartment. Extend a ground bus into the circuit breaker compartment to automatically ground the breaker frame with high-current spring type grounding contacts located on the breaker chassis when in the test and connected positions. Guide rails for positioning the circuit breaker and all other necessary hardware are to be an integral part of the circuit breaker compartment. Blocking devices shall interlock breaker frame sizes to prevent installation of a lower ampere rating or interrupting capacity element into a compartment designed for one of a higher rating. It shall be possible with indoor switchgear to install a circuit breaker into a bottom compartment without use of a transport truck or lift device.

C. Ground Bus

1. A ¼ inch x 2 inch copper ground bus shall extend through the entire length of the transfer switch.

D. Main Bus Compartment
Note to Specifier: All 3000 A bus will be silver-plated copper

1. The main bus is to be rated [1200] [2000] [3000] amps and be fully insulated for its entire length with an epoxy coating by the fluidized bed process. The conductors are to be [silver-plated copper] and be of a bolted [not welded] design. Access to this compartment is gained from the front or rear of the structure by removing a steel barrier. Provide standard provisions for future extension, as applicable.

E. Doors and Panels

1. Relays, control switches, etc., shall be mounted on a formed front-hinged panel for each circuit breaker compartment. Front doors shall include features to facilitate quick and complete removal or reinstallation of entire front door assembly. Door hinges shall have removable pins. Where allowable, all control circuits (except, for example, current transformers and grounding) shall be wired via plugs/receptacles prior to termination.

F. Circuit Breakers

2. The circuit breakers shall be rated [___] nominal volts, [4760] [15000] maximum volts, 60 Hz, with a continuous current rating of [1200] [2000] [3000] amps and a maximum symmetrical interrupting rating* of [40kA/250mVA - 4.76 kV system] [50kA/350MVA - 4.76 kV system] [25kA/500MVA - 15 kV system] [40kA/750MVA - 15 kV system] [50kA/1000MVA - 15 kV system]. Furnish vacuum circuit breakers with one vacuum interrupter per phase. Breakers of same type and rating shall be completely interchangeable. The circuit breaker shall be operated by means of a stored energy mechanism which is normally charged by a universal motor but can also be charged by the manual handle supplied on each breaker for manual emergency closing or testing. The closing speed of the moving contacts is to be independent of both the control voltage and the operator. Provide a full front shield on the breaker. Secondary control circuits shall be connected automatically with a self-aligning, self-engaging plug and receptacle arrangement when the circuit breaker is racked into the connected position. Provision shall be made for secondary control plug to be manually connected in test position. A minimum of 4 auxiliary contacts (2a 2b), shall be provided for external use. 6 additional cell-mounted auxiliary contacts MOC type for external use shall be provided. [Provisions shall be made for 6 additional cell-mounted auxiliary contacts TOC type for external use.] The racking mechanism to move the breaker between positions shall be operable with the front door closed and position indication shall be visible with door closed.
** Maximum symmetrical kA interrupting ratings are based on Table 1 of C37.06-1997. MVA ratings are nominal reference values for comparison only.*

3. An interlocking system shall be provided to prevent racking a closed circuit breaker to or from any position. An additional interlock shall automatically discharge the stored-energy operating mechanism springs upon removal of the breaker out of the compartment.

4. The circuit breaker control voltage shall be: 250 volts DC, 120 volts ac -one capacitor trip unit provided for each circuit breaker with ac control power.

G. Instrument Transformers

1. Voltage transformers are drawout mounted with primary current-limiting fuses and shall have ratio as indicated. The transformers shall have mechanical rating equal to the momentary rating of the circuit breakers and shall have metering accuracy per ANSI Standards.

2. Current transformers*: Each breaker compartment shall have provision for mounting of optional current transformers per phase* (ANSI standard relay accuracy). The current transformer assembly shall be insulated for the full voltage rating of the switchgear. The current transformers wiring shall be Type SIS [#16] [___] AWG minimum. [Shorting terminal blocks shall be provided; ring tongue connectors shall be used.]
**Relaying and metering accuracy shall conform to ANSI Standards.*

H. Control Wiring

1. The switchgear shall be wired with Type SIS [#14] [___] AWG minimum. The control wiring shall be UL listed and have VW-1 flame retardant rating. Wires shall terminate on terminal blocks with marker strips numbered in agreement with detailed connection diagrams.

2.03 Fabrication

A. Construction: Each equipment bay shall be a separately constructed cubicle assembled to form a rigid freestanding unit with sufficient bracing to minimize distortion. Minimum sheet metal thickness shall be 11 gauge steel on all exterior surfaces. Adjacent bays shall be securely bolted together to form an integrated rigid structure. The rear covers shall be removable to assist installation and maintenance of bus and cables.

B. The metal-clad switchgear shall be fully assembled, inspected and tested at the factory prior to shipment. Large line-ups shall be split to permit normal shipping and handling as well as for ease of rejoining at the job site.

2.04 Factory Finishing

A. All steel parts, shall be cleaned and a [zinc-phosphate (outdoor equipment)] [iron phosphate (indoor equipment)] pre-treatment applied prior to paint application.

B. Paint color shall be ANSI-61 [light grey]; TGIC polyester powder applied electro statically through air. Following paint application, parts shall be baked to produce a hard durable finish. The average thickness of the paint film shall be 2.0 mils. Paint film shall be uniform in color and free from blisters, sags, flaking and peeling.

C. Adequacy of paint finish to inhibit the buildup of rust on ferrous metal materials shall be tested and evaluated per paragraphs 5.2.8.1-7 of ANSI C37.20.2-1987. Salt spray withstand tests in accordance with ASTM #D-1654 and #B-117 shall be periodically performed on a sample to confirm conformance with the corrosion resistance standard of at least [2500 hours minimum (outdoor equipment)] [600 hours minimum (indoor equipment)].

2.05 Microprocessor Controller

A. The controller's sensing and logic shall be provided by a single built-in microprocessor for maximum reliability, minimum maintenance, and the ability to communicate serially through an optional serial communication module.

B. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance. Sensing and control logic shall be provided on multi-layer printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers. The panel shall be enclosed with a protective cover and be mounted separately from the transfer switch unit for safety and ease of maintenance. The protective cover shall include a built-in pocket for storage of the operator’s manuals.

C. All customer connections shall be wired to a common terminal block to simplify field-wiring connections.

D. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:

EN 55011	Emission standard - Group 1, Class A
EN 50082-2	Generic immunity standard, from which:
EN 61000-4-2	Electrostatic discharge (ESD) immunity
ENV 50140	Radiated Electro-Magnetic field immunity
EN 61000-4-3	Radiated RF Electromagnetic Field Immunity
EN 61000-4-4	Electrical fast transient (EFT) immunity
EN 61000-4-5	Surge transient immunity
EN 61000-4-6	Conducted Radio-Frequency field immunity
EN 61000-4-11	Voltage Dips, Interruption and Variations Immunity

2.06 Enclosure

A. All standard and optional door-mounted switches and pilot lights shall be 16-mm industrial grade type or equivalent for easy viewing & replacement.

PART 3 OPERATIONS

3.01 Controller Display and Keypad

A. A four line, 20 character LCD display and keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through the serial communications input port. The following parameters shall only be adjustable via DIP switches on the controller:

1. Nominal line voltage and frequency

2. Single or three phase sensing

3. Operating parameter protection

4. Transfer operating mode configuration
(Open transition, Closed transition, or Delayed transition)

To appropriately trained operators, all instructions and controller settings shall be easily accessible, readable and accomplished without the use of codes, calculations, or instruction manuals.

3.02 Voltage, Frequency and Phase Rotation Sensing

A. Voltage and frequency on both the normal and emergency sources (as noted below) shall be continuously monitored, with the following pickup, dropout, and trip setting capabilities (values shown as % of nominal unless otherwise specified):

Parameter	Sources	Dropout / Trip	Pickup / Reset
Undervoltage	N&E,3ϕ	70 to 98%	85 to 100%
Overvoltage	N&E,3ϕ	102 to 115%	2% below trip
Underfrequency	N&E	85 to 98%	90 to 100%
Overfrequency	N&E	102 to 110%	2% below trip
Voltage unbalance	N&E	5 to 20%	1% below dropout

B. Repetitive accuracy of all settings shall be within ± 0.5% over an operating

temperature range of -20°C to 60°C.

C. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via serial communications port access.

D. Source differential sensing shall be provided for the closed transition operating mode. The sensor shall enable transfer/re-transfer between live sources in the closed transition mode only when the two sources have a maximum voltage differential of 5%, frequency differential of 0.2 Hz and are within 5 electrical degrees.

E. Closed transition transfer shall be accomplished with no power interruption and without altering or actively controlling standby generator set.

F. The controller shall be capable (when activated by the keypad or through the serial port) of sensing the phase rotation of both the normal and emergency sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC or CBA).

G. Source status screens shall be provided for both normal & emergency to pro-vide digital readout of voltage on all 3 phases, frequency, and phase rotation.

3.03 Automatic and User Supervised Non-Automatic Control

A. Open, Closed, and Delayed Transition Switching Solutions provide complete automatic control of the transfer switch. Because ASCO 7000 Series Transfer Switches are constructed as Metal-Clad Switchgear, they also include full function Non-Automatic Control to permit safe, electrically interlocked user supervised operation.

B. A Transfer Switch Automatic-Manual selector switch allows the user to place the transfer switch in a fully manual mode of operation. The Normal and Emergency Source Circuit Breakers may then be operated using the circuit breaker control switches on the front of each circuit breaker compartment. This provides electrically interlocked operation to ensure that both circuit breakers cannot be closed simultaneously. Additionally, the Normal or Emergency Source Circuit Breakers may be tripped open by the circuit breaker control switches at any time during Automatic or Manual operation.

C. Included Components:

1. “Transfer Switch Auto-Man” Utility Quality Selector Switch.

2. “Breaker Control” Utility Quality Switch. One each for Normal & Emergency Circuit Breaker.
- **a.** Trip, Close, and Pull to Lock
- **b.** Closed LED – Red
- **c.** Open LED – Green
- **d.** Tripped LED – Amber (When Optional Protective Relaying is provided)

3. Controls Not In Auto LED (Indicates Automatic Operating Mode Disabled).

3.04 Time Delays

A. An adjustable time delay of 0 to 6 seconds shall be provided to override momentary

normal source outages and delay all transfer and engine starting signals. Capability shall be provided to extend this time delay to 60 minutes by providing an external 24 VDC power supply.

B. A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.

C. An adjustable time delay of 0 to 6 seconds to override momentary emergency source outage to delay all retransfer signals during initial loading of engine generator set.

D. Two time delay modes (which are independently adjustable) shall be provided on re-transfer to normal. One time delay shall be for actual normal power failures and the other for the test mode function. The time delays shall be adjustable from 0 to 10 hours. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.

E. A time delay shall be provided on shut down of engine generator for cool down, adjustable from 0 to 60 minutes.

F. A time delay activated output signal shall also be provided to drive an external relay(s) for selective load disconnect control. The controller shall have the ability to activate an adjustable 0 to 5 minute time delay in any of the following modes:

1. Prior to transfer only.

2. Prior to and after transfer.

3. Normal to emergency only.

4. Emergency to normal only.

5. Normal to emergency and emergency to normal.

6. All transfer conditions or only when both sources are available.

G. The controller shall also include the following user-adjustable time delays for optional Closed Transition and Delayed Transition operation:

1. FailToSyncTD: failure to synchronize normal and emergency sources prior to closed transition transfer.

2. XtdParallelTD: extended parallel condition of both power sources during closed transition operation.

H. All time delays shall be adjustable in 1 second increments, except the extended parallel time, which shall be adjustable in .01 second increments.

I. All time delays shall be adjustable by using the LCD display and keypad or with a remote device connected to the serial communications port.

3.05 Additional Features

A. A three position momentary-type test switch shall be provided for the ***test / automatic / reset*** modes. The test position will simulate a normal source failure. The reset position shall bypass the time delays on either transfer to emergency or retransfer to normal.

B. A SPDT contact, rated 5 amps at 30 VDC, shall be provided for a low-voltage engine

start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.

C. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the CTTS is connected to the normal source and one contact closed, when the CTTS is connected to the emergency source.

D. LED indicating lights (16 mm industrial grade, type 12) shall be provided; one to indicate when the CTTS is connected to the normal source (green) and one to indicate when the CTTS is connected to the emergency source (red).

E. LED indicating lights (16 mm industrial grade, type 12) shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal and emergency sources, as determined by the voltage sensing trip and reset settings for each source.

The following features shall be built-in to the controller, but capable of being activated through keypad programming or the serial port only when required by the user:

F. Provide the ability to select “commit/no commit to transfer” to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.

G. Engine Exerciser - The controller shall provide an internal engine exerciser. The engine exerciser shall allow the user to program up to seven different exercise routines. For each routine, the user shall be able to:

i. Enable or disable the routine.

ii. Enable or disable transfer of the load during routine.

iii. Set the start time:

- Time of day
- Day of week
- Week of month (1st, 2nd, 3rd, 4th, alternate or every)

iv. Set the duration of the run.

At the end of the specified duration the switch shall transfer the load back to normal and run the generator for the specified cool down period. A 10-year life battery that supplies power to the real time clock in the event of a power loss will maintain all time and date information.

The following feature shall be built - into the controller, but capable of being activated through keypad programming or the communications interface port.

H. Terminals shall be provided for a remote contact which opens to signal the CTTS to transfer to emergency.

I. System Status - The controller LCD display shall include a “System Status” screen which shall be readily accessible from any point in the menu by depressing the “ESC” key a maximum of two times. This screen shall display a clear description of the active operating sequence and switch position. For example,
Normal Failed
Load on Normal

TD Normal to Emerg
2min15s

Controllers that require multiple screens to determine system status or display "coded" system status messages, which must be explained by references in the operator's manual, are not permissible.

J. Self Diagnostics - The controller shall contain a diagnostic screen for the purpose of detecting system errors. This screen shall provide information on the status input signals to the controller which may be preventing load transfer commands from being completed.

K. Communications Interface – The controller shall be capable of interfacing, through an optional serial communication module, with a network of transfer switches, locally (up to 4000 ft.) or remotely through modem serial communications. Standard software specific for transfer switch applications shall be available by the transfer switch manufacturer. This software shall allow for the monitoring, control and setup of parameters.

L. Data Logging – The controller shall have the ability to log data and to maintain the last 99 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non-volatile memory:

1. Event Logging
- **a.** Data and time and reason for transfer normal to emergency.
- **b.** Data and time and reason for transfer emergency to normal.
- **c.** Data and time and reason for engine start.
- **d.** Data and time engine stopped.
- **e.** Data and time emergency source available.
- **f.** Data and time emergency source not available.

2. Statistical Data
- **a.** Total number of transfers.
- **b.** Total number of transfers due to source failure.
- **c.** Total number of days controller is energized.
- **d.** Total number of hours both normal and emergency sources are available.

O. Communications Module - A full duplex RS485 interface shall be installed in the CTTS controller to enable serial communications. The serial communications shall be capable of a direct connect or multi-drop configured network. This module shall allow for the seamless integration of existing or new communication transfer devices. The serial communication interface shall be equal to ASCO Accessory 72A.

PART 4 ADDITIONAL REQUIREMENTS

4.01 Tests and Certification

A. The complete CTTS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

B. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

C. The CTTS manufacturer shall be certified to ISO 9001:2008 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001:2008.

D. The equipment shall be factory tested to simulate a complete and integrated system. The circuit breakers supplied shall be installed in their actual positions and electrically and mechanically tested. A narrative of the system operation shall be provided and shall be utilized when testing the equipment. Copies of the test reports shall be provided.

E. Upon request at order placement, the manufacturer shall provide upon completion of the order a certificate of seismic qualifications.

F. Circuit breaker test reports [shall] [shall not] be provided.

G. Customer inspection of equipment and witnessing of factory tests [shall] [shall not] be provided.

H. All tests shall comply with applicable ANSI standards.

1. Dielectric Test: ANSI C37.20 Para. 5.3.1, latest revision.

2. Mechanical Test: ANSI C37.20 Para. 5.3.2, latest revision.

3. Grounding of Instrument Transformer Case Test: ANSI C37.20 Para. 5.3.3, latest revision.

4. Electrical Operation & Control Wiring Test: ANSI C37.20 Para. 5.3.3, latest revision.

5. Polarity Test: ANSI C37.20 Para. 5.3.4.3, latest revision.

6. Sequence Test: ANSI C37.20 Para. 5.3.4.4, latest revision.

4.02 Service Representation

A. The CTTS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

B. The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.

****Note Spec Writer:*** *The following section is optional and should be deleted if not used.*

PART 5 OPTIONAL FEATURES

5.01 *POWER MANAGER*

1. *Furnish Power Managers at locations shown to monitor all functions specified below.*

2. *The Power Managers shall be listed to UL 3111-1, CSA, CE Mark, and*

industrially rated for an operating temperature range of -20°C to 60°C.

3. *The Power Manager shall be accurate to 1% measured, 2% computed values and display resolution to .1%. Voltage and current for all phases shall be sampled simultaneously to assure high accuracy in conditions of low power factor or large waveform distortions (harmonics).*

4. *The Power Manager shall be capable of operating without modification at nominal frequencies of 45 to 66 Hz and over a control power input range of 20 – 32VDC.*

5. *Each Power Manager shall be capable of interfacing with an optional communications module to permit information to be sent to central location for display, analysis, and logging.*

6. *The Power Manager shall accept inputs from industry standard instrument transformers (120 VAC secondary PTs and 5A secondary CTs.) Direct phase voltage connections, 600 VAC and under, shall be possible without the use of PTs.*

7. *The Power Manager shall be applied in single, 3-phase, or three & four wire circuits. A fourth CT input shall be available to measure neutral or ground current.*

8. *All setup parameters required by the Power Manager shall be stored in non-volatile memory and retained in the event of a control power interruption.*

9. *The following metered readings shall be communicated by the Power Manager, via serial communication, when equipped with optional serial communications module:*

- **b.** *Current, per phase RMS and neutral (if applicable)*
- **c.** *Current Unbalance %*
- **d.** *Voltage, phase-to-phase and phase-to-neutral*
- **e.** *Voltage Unbalance %*
- **f.** *Real power (KW), per phase and 3-phase total*
- **g.** *Apparent power (KVA), per phase and 3-phase total*
- **h.** *Reactive power (KVAR), per phase and 3-phase total*
- **i.** *Power factor, 3-phase total & per phase*
- **j.** *Frequency*
- **k.** *Accumulated Energy, (MWH, MVAH, and MVARH)*

The following energy readings shall be communicated by the Power Manager:

- **a.** *Accumulated real energy KWH*
- **b.** *Accumulated reactive energy KVAH*
- **c.** *Accumulated apparent energy KVARH*

NOTE: For real and reactive energy reported values, separate total for energy flow from each source shall be stored, including the arithmetic sum.

10. *Power Manager Input/Output Options.*

- **a.** *Power Managers shall be equipped with the following I/O:*

1) *Provide (8) solid state status inputs.*
2) *Provide four (4) relay output contacts.*

****Note Spec Writer:*** *The following section is optional and should be deleted if not used.*
The Power Manager *shall flush mount to an enclosure.*

1. *The Power Managers shall be equipped with an optional continuous duty, long-life, 4 line x 20 character LCD backlit display to provide local access to the following metered quantities:*
- ***a.*** Current, per phase RMS and neutral (if applicable)
- ***b.*** Current Unbalance %
- ***c.*** Voltage, phase-to-phase and phase-to-neutral
- ***d.*** Voltage Unbalance %
- ***e.*** Real power, per phase and 3-phase total
- ***f.*** Apparent power, per phase and 3-phase total
- ***g.*** Reactive power, per phase and 3-phase total
- ***h.*** Power factor, 3-phase total & per phase
- ***i.*** Frequency
- ***j.*** Accumulated Energy, (MWH, MVAH, and MVARH)

2. *Displaying each of the Power Manager quantities shall be accomplished through the use of menu scroll buttons.*

3. *For ease in operator viewing, the display shall remain on continuously, with no detrimental effect on the life of the Power Manager.*

4. *Setup for system requirements shall be allowed from the front of the Power Manager. Setup provisions shall include:*
- ***a.*** *CT rating (xxxxx:5)*
- ***b.*** *PT rating (xxxxxxx:120) (if applicable; 14400V maximum)*
- ***c.*** *System type (single; three phase; 3 and 4 wire)*
- ***d.*** *Communication parameters*

5. *Reset of the following electrical parameters shall also be allowed from the front of the Power Manager:*
- ***a.*** *Real energy (MWH), apparent energy (MVAH) and reactive energy (MVARH).*

6. *All reset and setup functions shall have a means for protection against unauthorized/accidental changes.*

5.02 Protective Relays: Provide relays as indicated on drawings for each circuit breaker.

***Note to Specifier: Add details for protective relays, including relay types and model numbers for clarity. ***