CTS SERIES AUTOMATIC TRANSFER SWITCH

The Cat® CTS Series Automatic Transfer Switch (ATS) is configurable for applications requiring the dependability and ease of operation found in a full featured power contactor type transfer switch.

The CTS Series is equipped with the MX250 controller that is designed for the most demanding transfer or bypass switch applications.

FEATURES

ELECTRICAL RATINGS

- Ratings 40 to 4000 amperes
- 2, 3 or 4 Poles
- NEMA 1, 3R, 4, 4X and 12
- Available to 600 VAC, 50 or 60 Hz
- Suitable for emergency and standby applications on all classes of load, 100% tungsten rated through 400 amps
- UL 1008 listed at 480 VAC
- CSA C22.2 No. 178 certified at 600 VAC
- IEC 947-6-1 listed through 480 VAC

PERFORMANCE FEATURES

- Contact transfer speed less than 100 milliseconds
- High close-in and withstand capability
- Temperature rise test per UL 1008 conducted after overload and endurance tests in unventilated enclosure – exceeds UL requirements
- Equipped with the MX250 Control Package

DESIGN AND CONSTRUCTION FEATURES

- Double throw, interlocked operation
- Electrically operated, mechanically held by a simple, over-center mechanism
- Silver alloy contacts with separate arcing contacts on 600 amp and above
- Arc quenching grids, enclosed arc chambers, and wide contact air gap for superior source to-source isolation on all units
- Control circuit disconnect plug and drive inhibit switch for safe maintenance
- Components accessible for inspection and maintenance without removal of the switch or the power conductors
- Mechanical indicator and contact chamber cover designed for inspection, safety and position designation

THE CAT CTS SERIES OF AUTOMATIC TRANSFER SWITCHES

The Cat CTS Series power contactor Type transfer switch makes use of a fully programmable/configurable microprocessor-based controller to allow the utmost in application flexibility. Further, the CTS Series is offered in a wide array of configurations enabling it to meet the needs of even the most highly critical load.

Available configurations include:

40-4000 Amps:

- CTS Automatic Transfer Switches
- CTSD Delayed Transition Transfer Switches
- CTSM Manual Transfer Switches

100-4000 Amps:

- CTSCT Closed Transition Transfer Switches
- CBTS Automatic Transfer/Bypass Switches
- CBTSD Delayed Transition Bypass Switches
- CBTSCT Closed Transition Bypass Switches

All CTS products meet or exceed industry requirements to allow specification and installation with confidence.

- UL 1008 listed through 480 VAC
- CSA C22.2 No. 178 listed through 600 VAC
- IEC 947-6-1 listed through 480 VAC
- Codes and Standards
  NFPA 70, 99, 101, 110
  NEC 517, 700, 701, 702
  IEEE 446, 241
  NEMA ICS2-447
- Controls tested in accordance with:
  IEEE 472 (ANSI C37.90A)
  EN55022 Class B (CISPR 22)
  (Exceeds EN55011 & MILSTD 461 Class 3)
  EN61000-4-2 Class B (Level 4)
  EN61000-4-3 (ENV50140) 10v/m
  EN61000-4-4
  EN61000-4-5, IEEE C62.41
  EN61000-4-6 (ENV50141)
  EN61000-4-11
- Equipment (Controls and Power Section)
  Seismic Test Qualified to:
  IBC-2003
  IEEE-693-2005
- Enclosures meet the requirements of:
  UL 508, UL 50, ICS 6, ANSI C33.76 and NEMA 250
- Quality System:
  ISO 9001 Registered

This ruggedly built family of power contactor switches has been specifically designed for transfer switch duty with dependability, versatility and user friendliness of prime concern.
The CTS power panel components, consisting of power switching contacts, drive mechanism and terminal lugs, are mounted on a specially formed backplane. Logic devices including microprocessor control auxiliary time delays and special accessory equipment are assembled on the door for ease of maintenance and separation from the power section. They are connected with a numbered wiring harness equipped with a disconnect plug that allows isolation of the control panel for maintenance.

CTS SERIES METHOD OF OPERATION

When the normal source fails or the voltage drops to a predetermined point (usually 80% of nominal), if required, a circuit is closed to start the engine generator set. When the emergency source reaches 90% of rated voltage and 95% of rated frequency, the drive solenoid is energized through the emergency coil control relay, causing the main contacts to disconnect the load from the normal source and connect it to the emergency source. After the drive solenoid has completed its electrical stroke and is seated, the emergency coil control relay opens to disconnect it. The transfer switch is now mechanically locked in the emergency position. When normal voltage is restored to a predetermined point (usually 90% of nominal), the control voltage sensing energizes. The normal side coil relay closes, and after the drive solenoid has completed its electrical stroke and is seated, the coil control relay opens to disconnect it. The transfer switch is now mechanically locked in the normal position.

DRIVE MECHANISM

All CTS switches employ the simple “over-center” principle to achieve a mechanically locked position in either normal or emergency and a high speed drive assures contact transfer in 100 ms or less. High contact pressure and positive mechanical lock allow for high withstand and closing ratings, far exceeding UL requirements.

NEUTRAL SWITCHING
The CTS Series is available in true four pole designs for multi-source power systems that require switching the neutral. The neutral contact is on the same shaft as the associated main contacts. This design ensures positive operation, and prevents any possibility that the neutral contact will fail to open or close, as is possible when the neutral pole is an add-on accessory. The neutral contacts are identical to the main contacts, having the same current carrying and high withstand /closing ratings as the mains. They are designed to *break last and make first* to negate the possibility of transients while switching the neutral.

SAFE MANUAL OPERATION
The CTS manual operator consists of a large, easy-to-use handle that fits securely for manual operation during installation and maintenance or in an emergency.
Every CTS is provided with an operator inhibit switch to disconnect the electrical drive prior to maintenance. Fully enclosed wrap-around arc covers shield the main contacts and mechanical components, preventing operator exposure during manual operation

TRANSFERRING LARGE MOTOR OR HIGHLY INDUCTIVE LOADS
Some loads, especially large motors receive severe mechanical stress if power is transferred out of phase while the motor is still rotating. Also, back EMF generated by a motor can result in over currents that can blow fuses or trip circuit breakers. The CTS Series offers four solutions to these problems:

1. **Optional Universal Motor Disconnect Contact:** This load control disconnects a large motor via its control circuit for an adjustable period of time prior to transfer in either direction. For switching multiple motors, the motor disconnect contact with staged restart disconnects the motors prior to transfer and brings them back on line sequentially.

2. **Accessory R50 Phase Monitor:** This feature compares the phase angle between both sources of power and prevents transfer until the two are approximately in phase (within a self adjusting range). The CTS's high speed transfer action coupled with the MX series microprocessor control logic ensure closures at or near zero degree phase difference

CTS SERIES ATS
400 amp, 2 pole

3. **Series CTSD:** The CTSD offers a delayed transition on transfer switches 40A and above. This programmed center-off position allows for the full decay of rotating motors or transformer fields. It can also be used for load shedding of selected circuits or other applications which require a means to disconnect the load from either source. Many UPS system manufacturers recommend delayed transition switches to support sequencing of their systems. Reference the CTSD supplement for further details.

4. **Series CTSCT:** Cat closed transition switches combine CTSD operation during a source failure with a highly engineered control system that allows momentary paralleling (100 ms) of two acceptable sources, thereby limiting the impact of transfer on the load. Reference the CTSCT supplement for further details.

STANDARD FEATURES (MSTD PACKAGE)

Feature	Function
6/P	Momentary Test Switch
J2E/J2N	Adj. over/under freq (S1 and S2)
A3	Aux Contact (S2 position)
L1/L2	Source Position LEDs
A4	Aux Contact (S1 position)
L3/L4	Source Available LEDs
Calibrate	Volt. and Freq. calibration
LN/P	Center-Off Position LCD*
CDT	Load/No-Load Exerciser
P1	Source 2 Start Time Delay
DS	Auto/Inhibit Switch (> 600A)
R50	In-Phase Monitor
DT	Time Delay – Neutral to S1*
S13/P	Transfer Commit
DW	Time Delay – Neutral to S2*
T	Source 1 Stable Time Delay
E	Engine Start Contact
U	Source 2 Stop Time Delay
EL/P	Log of last 16 events and System Data
VI	Voltage Imbalance
K/P	S1 and S2 Freq. Indication
W	S2 Stable Time Delay
YEN	Bypass T and W Time Delays

**Available with Delayed Transition switches only.*

OPTIONAL PACKAGES

Exerciser (MEXE) Package, includes:
- STDS Functions
- A1/A1E – S1/S2 Failure aux contact
- A3/A4 – One additional contact each
- CDP – Programmable exerciser
- Q2 – Remote Peak Shave/Load Test
- R16 – Phase Rotation Sensing

Controls (MCON) Package, includes:
- EXES Functions
- Q3 – Remote Inhibit transfer to Emergency
- Q7 – Inhibit Transfer to Normal
- T3/W3 – Elevator Pre-Signal Aux Contacts
- UMD – Universal Motor Load Disconnect

Sensing (MSEN) Package, includes:
- EXES Functions
- Normal Source Over voltage sensing (3 phase)
- Q7 – Inhibit Transfer to Normal
- S12P – Auto/Manual Selector Switch

Special (MSPE) Package, includes:
- CONS Functions
- SENS Functions
- S5P – Manual transfer to Normal Switch (Replaces S12P)

Switchgear (MPSG) Package, includes:
- SPES Functions
- Additional set of A3/A4 Contacts
- R15 – Load Shed to “Dead Normal” or
- R15D – Load Shed to Neutral Position*
- S12/P – Auto-Manual Selector Switch

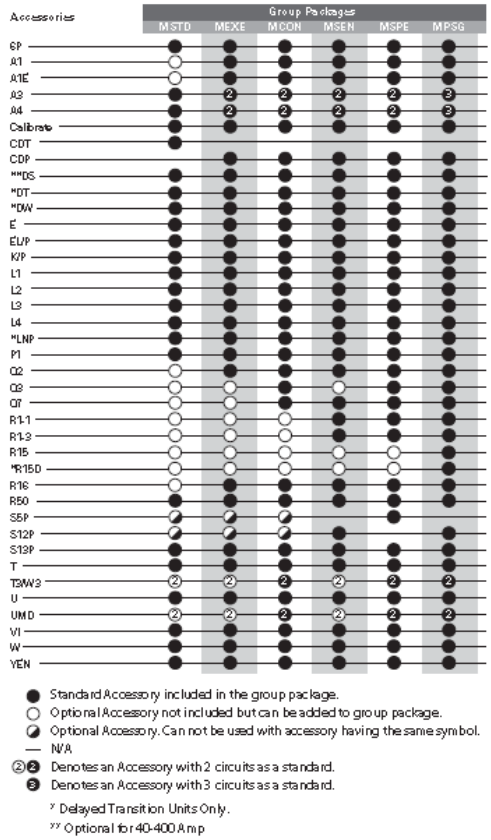
Screenshot of ATS operating parameters on Cat Switchgear HMI.

Combined with the optional Modbus Communication Card, the PSGS package allows for integration with Cat Switchgear. This feature allows ATS operating parameters to be displayed on the PowerLynx® 3000 HMI as well as on the optional Remote Monitoring Software. Supply of this feature set affords real-time monitoring of the ATS as well as direct control over the following parameters from the Switchgear HMI:
- Timer Settings
- Pickup/Dropout settings
- Testing Functions
- Alarm functions
- Manual operation

CTS SERIES ACCESSORY DEFINITIONS

6P
Microprocessor activated test switch (Momentary)
6A
Hardwired test switch (Maintained)
6AP
Microprocessor activated test switch (Maintained)
6BK
Hardwired test switch (Maintained Auto – Momentary Test) Key operated
6CK
Hardwired test switch (Maintained Auto – Maintained Test) Key operated
A1
Auxiliary Contact S.P.D.T. – Normal (Source 1) Failure
A1E
Auxiliary Contact S.P.D.T. – Emergency (Source 2) Failure
A3
Auxiliary Contact – closed in emergency (Source 2) Additional available (10 max.) on CTS Series and need to be specified
A4
Auxiliary Contact – closed in normal (Source 1) Additional available (10 max.) on CTS Series and need to be specified
A62
Motor disconnect and staged restart (1 contact)
AB3
Auxiliary contact – closed in bypass emergency (Source 2) (S.P.D.T.) (Standard up to 400A) Additional available (10 max.) on CBTS Series and need to be specified
AB4
Auxiliary contact – closed in bypass emergency (Source 1) (S.P.D.T.) (Standard up to 400A) Additional available (10 max.) on CBTS Series and need to be specified
CALIBRATE
Microprocessor activated calibration feature
CDP
Programmable exerciser daily, 7/14/28/365 days user-selectable, with or without load
CDT
Exerciser no load timer
CTAP
Chicago transfer alarm panel mounted in door of enclosure. Includes 3 aux. contacts and fuse.
DS
Disconnect Switch. Disconnects source voltage to transfer power panel.
DT (DELAYED TRANSITION ONLY)
Time Delay from Neutral Switch position to Source 2 on retransfer
DW (DELAYED TRANSITION ONLY)
Time Delay from Neutral Switch position to Source 2 on retransfer
E
Engine Start Relay
EL/P
Event log of last 16 events
ETHERNET
Ethernet Communication Adapter. Requires Modbus Communication Module.
F
Fan contact, closed when engine runs.

CTS SERIES ACCESSORY GROUP MATRIX



CTS SERIES ACCESSORY DEFINITIONS (continued)

HT(1)(2)
Heater and Thermostat 208/240V (1) 380/600V (2) mounted and
inter-wired in enclosure. (requires larger enclosure for 40-200A)
K
Frequency Meter (Analog) – Door mounted
K/P
Frequency Indication on the controller
LNP
Center-off position LCD-Indicator
L1
LED light indicates Switch in Source 2 position
L2
LED light indicates Switch in Source 1 position
L3
LED light indicates Source 1 available
L4
LED light indicates Source 2 available

CTS SERIES ACCESSORY DEFINITIONS (continued)

LonWorks
LonWorks Communication Module
M1
Single Phase Amp Meter (Analog)
M2
Three Phase Amp Meter (Analog)
M90
EPM2000 True RMS Digital Meter with display (Amps, Volts, Power, Energy, Power Factor and Frequency). 3 Line LED Display. 50/60 Hz Universal Operation. 1 or 3 phase. Standard Modbus RTU RS485 communications capability.
M90A
Includes Modbus communication card and factory wiring between EPM2000 and Modbus communication card.
M90B
Includes Modbus communication card, Ethernet communication adapter and factory wiring between EPM2000 and Modbus communication card.
M91
EPM6000 True RMS Digital Meter with display (Amps, Volts, Power, Energy, Power Factor and Frequency, THD). Certified energy and demand metering. Meets ANSI C12.20 and IEC 687 Accuracy Classes. Front IrDA Port Laptop Connection. Standard Modbus RTU RS485 or DNP 3.0 communications capability.
M91A
Includes Modbus communication card and factory wiring between EPM6000 and Modbus communication card.
M91B
Includes Modbus communication card, Ethernet communication adapter and factory wiring between EPM6000 and Modbus communication card.
Modbus
Modbus RTU Communication Module
N1
Running Time Indicator – Door mounted
N2
Operation Counter – Door Mounted
P1
Engine Start Timer (adjustable to 6 seconds)
P2
Engine Start Timer – Extended time delay (adjustable to 300 seconds)
Q2
Peak shave/remote load test/area protection – Relay (S.P.D.T.) (Need to specify voltage – 120 VAC, 24 VAC, 24 VDC – 120V default standard)
Q3
Inhibit transfer to emergency (Source 2) (load add relay) – Relay (S.P.D.T.) (Need to specify voltage – 120 VAC, 24 VAC, 24 VDC – 120V default standard)
Q7
Inhibit transfer to normal (Source 1) – Relay (S.P.D.T.) (Need to specify voltage – 120 VAC, 24 VAC, 24 VDC – 120V default standard)
R1-1/R1-3
Over Voltage sensing for normal (Source 1) single (R1-1) or three (R1-3) phase
R15/R15D
Load Shed. Should Source 2 become overloaded, a signal can be given to switch to the Neutral position.
R16
Phase rotation sensing of Normal (Source 1) and Emergency (Source 2)
R26/R26D
Interruptible Power Rate Provisions. Allow transfer out of Source 1 position to Mid position or dead Source 2. Alarm and Pre-Signal circuit included. (Need to specify voltage – 120 VAC, 24 VAC, 24 VDC
R50
In Phase monitor between Normal (Source 1) and Emergency (Source 2) to allow transfer
S5P
Microprocessor activated auto/manual retransfer selector switch for transferring to Normal (Source 1) (includes microprocessor activated YN accessory)
S12P
Microprocessor activated auto/manual retransfer selector switch for transferring to Normal (Source 1) (includes microprocessor activated YN & YE accessory)
S13P
Microprocessor activated commit/no commit on transferring to Emergency (Source 2) (with enable/disable settings)
S14K
Keyed selector switch for retransfer to normal-test-auto
SW1
Auto/Off/Start Engine control selector – Door mounted (keyed or non-keyed operation available)
SW2
Auto/Off Engine control selector – Door mounted (keyed or non-keyed operation available)
SW3
Source Priority Selector Switch – Door mounted. Allows selection of Source 1 or Source 2 to be the Prime Source. Transfer Switch will transfer to selected Prime Source if that Source is available. (keyed or non-keyed operation available)
T
Retransfer to Normal (Source 1) adjustable time delay
T3/W3
Pre-signal contact on transfer to Normal (Source 1) or Emergency (Source 2) during test
U
Engine stop /cool adjustable cool down timer
UMD
Pre and post transfer output adjustable time range. Functions in both directions. Includes 2 circuits. (Additional circuits available).
VI
Voltage imbalance between phases (3 Phase only)
W
Adjustable time delay on transfer to Emergency (Source 2)
YEN
Bypass transfer timers function (soft key switch in microprocessor)

CTS SERIES DIMENSIONAL SPECIFICATIONS

CTS Series Transfer Switches							
		NEMA 1 Enclosed					
Ampere Rating	Poles	Height (A)	Width (B)	Depth (C)	Reference Figure	Weight	Application Notes
40,80, 100 & 150	2,3	24 (610)	18 (457)	11 (279)	A	57 (26)	1-7
	4	24 (610)	18 (457)	11 (279)	A	60 (27)	
225, 260 & 400	2,3	46 (1168)	24 (610)	14 (356)	A	165 (75)	1-7
	4	46 (1168)	24 (610)	14 (356)	A	170 (68)	
600	2,3	74 (1880)	40 (1016)	20 (508)	B	380 (172)	1-8
	4	74 (1880)	40 (1016)	20 (508)	B	430 (195)	
800, 1000 & 1200	2,3	74 (1880)	40 (1016)	20 (508)	B	455 (206)	1-8
	4	74 (1880)	40 (1016)	20 (508)	B	540 (245)	
1600 & 2000	3	90 (2286)	36 (914)	48 (1219)	C	1010 (458)	1-8
	4	90 (2286)	36 (914)	48 (1219)	C	1160 (526)	
3000	3	90 (2286)	36 (914)	48 (1219)	C	1130 (513)	1-8
	4	90 (2286)	36 (914)	48 (1219)	C	1395 (633)	
4000	3	90 (2286)	47 (1194)	62 (1575)	C	1595 (723)	1-11
	4	90 (2286)	47 (1194)	62 (1575)	C	1850 (839)	

Application Notes :

1. Dimensions are listed in inches (mm) and weights in pounds (kg).
2. Includes 1.25" door projection beyond base depth. Allow a minimum of 3" additional depth for projection of handle, light, switches, pushbuttons, etc.
3. **All dimensions and weights are approximate and subject to change without notice and are not for construction use.**
4. Special enclosures (NEMA 3R, 4, 12, etc.) may include mounting tabs, etc. Consult the published dimension drawings for details.
5. Normal and emergency may be ordered inverted on any switch. The load may be inverted 500-1200 amps. Consult the factory for details.
6. Special lug arrangements may require different enclosure dimensions. For certified drawings, contact **Caterpillar**.
7. Packing materials must be added to weights shown. Allow 15% additional weight for cartons, skids, crates, etc.
8. Add 4" in height for removable lifting lugs.
9. 4000 amp depth dimension shown is standard. Depending on your cable/conduit requirements you may desire a deeper enclosure. Consult **Caterpillar** for further details.
10. Lug adapters for 3000-4000 amp limits may be staggered length for ease of entrance. Consult **Caterpillar** for details.
11. Ventilation louvers on side/rear of enclosure at 3000 and 4000A. One side or rear must be clear to afford proper airflow.

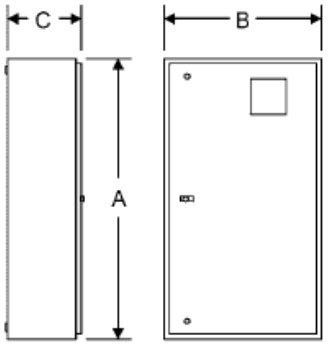


Figure A

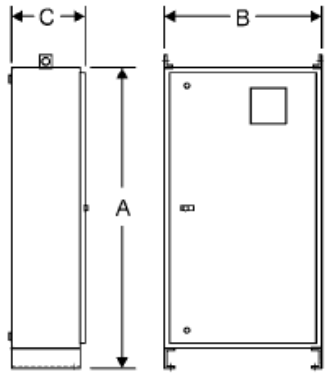


Figure B

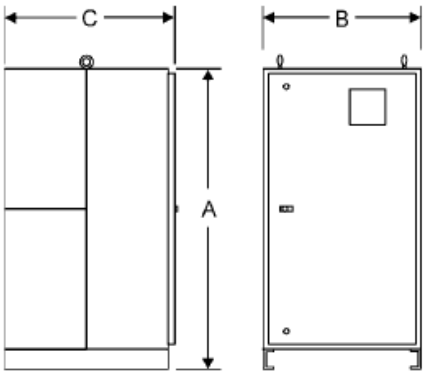


Figure C

AL-CU UL LISTED SOLDERLESS SCREW-TYPE TERMINALS FOR EXTERNAL POWER CONNECTIONS

Switch Size Amps	Normal, Emergency & Load Terminals		Switch Size Amps	Normal, Emergency & Load Terminals	
	Cables per Pole	Range of Wire Sizes		Cables per Pole	Range of Wire Sizes
40-80		#8 to 3/0 AWG	800/1000/1200	4	#2 AWG to 600 MCM
100-225	1	#6 AWG to 250 MCM	1600	8	600 MCM
260		#6 AWG to 350 MCM	2000		
400		#4 AWG to 600 MCM	3000		
600	2	#2 AWG to 600 MCM	4000		

NOTES:
* Line and load terminals are located in rear and arranged for bus bar connection.
1. Special terminal lugs and neutral bars are available at additional cost. Contact factory and advise cable sizes and number of conductors per pole.
2. Fully rated solid neutral (3x standard normal power connector) provided when required by system voltage.
3. Normal and emergency may be ordered inverted on any switch. Load may be inverted 600-1200 amps. Consult the factory for details.
4. Lug adapters for 3000-4000 amp units may be staggered length for ease of entrance. Consult the factory for details.
5. Special lug arrangements may require different enclosure dimensions. For certified drawings, contact **Caterpillar**

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