DS200TCEA – Emergency Overspeed Board

The Emergency Overspeed Board (TCEA), located in the Protective Core <P1>, is used for the high speed protection circuitry and is often referred to as the Protective Processor. The three TCEA boards used in the <P1> core are referred to as the <X>, <Y>, and <Z> processors. These boards each bring in signals for high and low shaft speed, flame detection and automatic synchronization. The signals are scaled and conditioned and written over the IONET to the STCA board in the <R1> core via the JX1 connector located on the TCEA board in location one, (<X>).

The TCEA boards in location three, (<Y>), and five, (<Z>), transfer their information using the JX1 and JX2 connections via <X>. The I/O Engine in the <R1> core uses the data from the three TCEA boards and performs a median select on the three values and the results are transferred across the COREBUS to the Control Engine. The TCEA boards send emergency trip signals to the Turbine Trip Board (TCTG), each TCEA board sends a trip signal to different relays. The three relays on the TCTG board perform a 2/3 vote (relay driver level voting), and the results determine whether the TCTG board trips the unit. Each TCEA board has its own power supply and power supply diagnostics.

TCEA Connectors

J7 – Distributes the power from the <PD> core to each TCEA board.

JK – Carries the signals to the TCEA board from the TCEB board in location two of the <P1> core. JK connects to either JKX, JKY or JKZ connectors on the TCEB board. This board is the Protection Termination Expander Board on which all of the signals are brought in and transferred to the TCEA boards. <X> connects to JKX, <Y> connects to JKY, and <Z> connects to JKZ.

JL – Carries the trip signals to the Turbine Trip Board (TCTG) in location four of the <P1> core. Each TCEA board connects to a different connection on the TCTG board. JL on <X> connects to JLX, JL on <Y> connects to JLY, and JL on <Z> connects to JLZ.

JW – Carries the 335 V dc for the flame detectors to the TCEB board. JW connects to the JWX/Y/Z connectors on the TCEB board. <X> connects to JWX, <Y> connects to JWY, and <Z> connects to JWZ.

JX1 – Daisy chained IONET connectors. JX1 on <X> connects to the JX connector on the TCQC board in the <R1> core. This IONET connection reads/writes all of the <P1> core signals and digital I/O, <Q11>, core signals to the I/O Engine in <R1>. JX1 on <Y> connects to the JX2 socket on <X> allowing it to be on the daisy chain. The JX1 connector on <Z> connects to the JX2 socket on <Y>. Again this allows it to be on the daisy chain. All of the signals are carried from board to board over the daisy chain until they arrive at the TCQC board in the <R1> core.

JX2 – Daisy chained IONET connectors. JX2 on <X> connects to the JX1 connector on <Y>. JX2 on <Y> connects to the JX1 connector on <Z>. The JX2 connector on <Z> connects to the TCDA board in the <Q11> core. This allows the digital signals to follow the daisy chain up the IONET to the <R1> core.

The hardware document in Appendix B and the signal flow diagrams in Appendix D contain more information.

TCEA Configuration

Hardware. The TCEA board's hardware jumpers J1 and J31 are used for factory test. J2 and J3 are used for IONET termination resistors. Hardware jumpers J4, J5 and J6 are used to set up the IONET address for each TCEA board. Overspeed trip frequency settings are confirmed using J12 through J21 for the high pressure shaft and J8 through J11 and J22 through 27 for the low pressure shaft. The actual configuration is done through the I/O configuration software. J28 and J29 hardware jumpers cause <Z> to always vote for a trip on emergency overspeed. J30 enables the stall timer. Refer to Appendix A and the hardware jumper screen on the operator interface for information on the hardware jumper settings for this board.

Software. The IO Configuration Editor is used to set the base speed and overspeed values for both the high and low pressure shafts and calculates the hardware jumper settings for trip frequency. The pulse rate information from the Ultra Violet (UV) flame detectors is selected and the auto-synchronization permissive values are chosen in the IO Configuration Editor as described below.

TCEA Flame Detection Circuits

Signals from the UV flame detectors are brought into the PTBA board in the <P1> core. These signals are read from the PTBA terminal board via the JVA and JU connectors to the TCEB board and are written to the TCEA board via the JK (JKX/Y/Z) connectors. The signals are scaled, conditioned and the intensity calculated using internal algorithms to determine the flame status. The flame detect signals are used by the Control Sequence Program (CSP) in the <R> core. These signals are sent via the IONET to the I/O Engine, which sends them to the Control Engine. JW (JWX/Y/Z) carries the 335 V dc to the flame detectors.

TCEA Turbine Overspeed Circuit

The I/O configuration constants determine the emergency overspeed trip level settings, and the hardware jumpers confirm the overspeed settings. The shaft speed magnetic pick-ups land on the PTBA terminal board in the <P1> core for the emergency overspeed circuit. The PTBA board parallels the signals to the <R1> core for use in Control Sequence Program for primary overspeed. The TCEA board calculates shaft speed using I/O configuration constants. The TCEA board compares the calculated shaft speeds with the I/O configuration constants trip values to detect an overspeed trip condition.

If a trip condition is detected, the circuit will de-energize the Emergency Trip Relays (ETRs) on the Turbine Trip Board (TCTG) to trip the unit. Hardware jumpers J28 and J29 on <Z> configure <Z> to always call for an emergency overspeed trip. J28 and J29 work in conjunction with the IONET address jumpers J4, J5, and J6 and embedded software. If the IONET address tells the TCEA board it is a <Z> board, the board will always vote for an emergency overspeed trip. This causes the system to have a dual redundant system for the emergency overspeed trip conditions. If either <X> or <Y> call for an emergency overspeed trip, the unit will trip. J28 and J29 must be set the same for <X>, <Y>, and <Z>.

TCEA Automatic Synchronizing Circuit

The bus and generator voltages from the PTBA terminal board are sent through the JV connector to the TCEB board where the JMP connector transferred them to the TCEA board. Embedded software in EPROMs on the TCEA board performs speed matching and voltage matching. The TCEA board sends the permissive to close the breaker after checking for proper generator and line voltages and frequencies and that the differential between the line and the generator is within the limits set by the I/O Configuration constant. The STCA board performs a separate synchronization check function, which sends a logic signal to the TCEA board. This logic must be satisfied to enable a breaker closure.