REDKOH INDUSTRIES, INC.

RK2000 MICROPROCESSOR TRANSFORMER CONTROL

TROUBLESHOOTING GUIDE

The following troubleshooting instructions are based on controls that have been installed correctly and have operated properly for some period of time.

If you are having problems while installing the control or upon initial operation, or if you have followed all the troubleshooting procedures and are still having a problem, please call our technical service department at +1 908 369 1590.

RK2000 Troubleshooting

PROBLEM

No Primary Voltage Reading (all other readings okay)

COURSE OF ACTION

The primary voltage signal is taken from the secondary of a potential transformer (PT) whose primary is across the primary of the transformer rectifier (TR). The PT has a voltage ratio of 600/20 volts. Therefore a voltage between 0 and 20 volts ac can be expected at the secondary of the PT, and across the two "VOLT" terminals on TB-5 of the Interface Unit, that is representative of 0 to 600 volts on the primary of the TR.

Measure the voltage at the primary of the TR (after the CLR, and calculate the appropriate ratio [(600/20) * (TR primary voltage/ X)]. The valve of X is the secondary voltage that should be across the two "VOLT" terminals. If the expected voltage is not present start tracing the voltage back to the PT. Either the wiring/connection between the PT and the Interface board is bad, the PT is bad or the signal to the primary of the PT is missing.

Some controls have fuses in series with the primary of the PT. These fuses may be either in the control cabinet, the low voltage junction box on the TR, or in the CLR enclosure mounted on the TR. Don't forget to check the fuses.

If the proper voltage is present across the two "VOLT" terminals, there is a malfunction on the Interface Unit. Return the Unit for repair.

RK2000 Troubleshooting

PROBLEM

No Primary Current Reading (all other readings okay).

COURSE OF ACTION

The primary current signal is a voltage reference signal derived across a shunt resistor that is located across the current transformer (CT). When the control is initially calibrated this resistor is set using the formula [15,000 / transformer primary current rating]. Once adjusted, the signal across the resistor will be 0 to 5 volts ac, corresponding to 0 to current rating.

Check the current with a true RMS ac clamp-on ammeter. Using the ratio [(rated current/5) * (measured current/x)] determine the voltage that should be across the resistor. That voltage should appear across the two “AMP” terminals on TB-5 on the Interface Unit. If the voltage is not present, start tracing the voltage back to the resistor. If the voltage is present at the resistor, the wiring or connections between the resistor and the “AMP” terminals are defective. If the voltage is not present across the resistor, the CT or the resistor could be defective. Replace these items, re-calibrate the resistor, and recheck the signal at the Interface Unit.

If the proper voltage signal is present across the two “AMP” terminals, there is a malfunction on the Interface Unit. Replace the Unit and return it for repair.

RK2000 Troubleshooting

PROBLEM

No Secondary Current Reading (all other readings okay).

COURSE OF ACTION

The secondary current signal is a voltage reference signal derived across a circuit on the TR signal-conditioning panel. This panel is located in the low voltage junction box or TR ground switch enclosure. Two resistors are calibrated during initial set-up to provide a 0 to 5 volt dc signal across terminals “MA(+)A” and “SEC COMMON (GND)” on TB-5 on the Interface Unit, when 0 to rated secondary current is present at the output of the transformer rectifier (TR). Using a ratio of the rated primary current to the actual measured primary current, an approximation of the secondary current signal can be made [(measured primary current/rated primary current)*5]. This approximate voltage should be present at terminals 40 and 15 on TB-3 on the Interface Panel.

If the approximated voltage is not present across terminals “MA(+)A” and “SEC COMMON (GND)”, trace the signal back to the signal conditioning panel. This panel is located in either the low voltage junction box or the TR ground switch enclosure. If the voltage is present at the signal-conditioning panel the wiring or connections between the interface panel and the conditioning panel are defective. If the voltage is not present at the conditioning panel, replace the panel, re-calibrate, and recheck the signal. If the signal still is not present there is probably a fault within the transformer tank. At this point call the manufacturer of the TR for help.

If the signal is present on the Interface Unit across terminals “MA (+)A” and “SEC COMMON (GND)”, there is a malfunction on the Unit. Replace the Unit and return it for repair.

RK2000 Troubleshooting

PROBLEM

No Secondary Voltage Reading (all other readings are okay).

COURSE OF ACTION

The secondary voltage signal is a reference voltage signal derived across a circuit on the TR signal-conditioning panel. This panel is located in the low voltage junction box or TR ground switch enclosure. A trim pot is provided for adjustment of each leg of the KV signal (KV1 & KV2) during initial set-up to provide a 0 to 5 volt dc signal across terminals “KV1” and “SEC COMMON (GND)” and “KV2” and “SEC COMMON (GND)” when 0 to rated secondary voltage is present at the output of the transformer rectifier (TR). Using the formula [(operating primary volts/rated primary volts) * 5] you can approximate the voltage that should be present between terminals “KV1” and “SEC COMMON (GND)” and “KV2” and “SEC COMMON (GND)”.

If the approximated voltage is not present at the Interface Unit, trace the voltage back to the signal-conditioning panel. If the voltage is present at the signal conditioning panel, the wiring or the connections between the conditioning panel and the Interface Unit are defective. If the voltage is not present at the conditioning panel, replace the panel, re-calibrate, and recheck the signal. If the signal is still not present there is probably a fault with the voltage divider resistor or the connection to the voltage divider resistor.

RK2000 Troubleshooting

PROBLEM

Under Voltage Trip (low or no primary or secondary voltage, high or rated primary or secondary current).

COURSE OF ACTION

If the primary voltage drops below the setting of the Under Voltage trip limit while the primary current remains greater than 20% of the rated current, the control will trip off. If this occurs, the message line on the display will read Under Voltage trip□. The cause of this condition is either a resistance ground or a dead short to ground downstream of high voltage transformer. In weighted wire type precipitators, a broken wire is the common cause. Additional causes could be a full hopper or high voltage insulators that have electrically tracked.

To isolate the problem, disconnect the precipitator load from the high voltage transformer rectifier (TR) and re-energize. If primary and secondary voltage is now present (there should be no primary or secondary current) the ground is located within the precipitator. If the voltage is still low or zero the problem is within the TR tank. For problems within the TR tank consult Redkoh Industries. For problems within the precipitator perform a complete internal inspection.

RK2000 Troubleshooting

PROBLEM

Over Current Trip

COURSE OF ACTION

If the microprocessor control system is programmed and operating properly, the only way an over current trip can occur is if one or both of the SCRs are shorted or miss firing. Start troubleshooting by disconnecting the gate and cathode leads of both SCRs at the Interface Unit. Tape the leads individually so they cannot touch other components. Re-energize the control and note the current and voltage levels. With the SCRs disconnected the current and voltage should be zero. If current and voltage are obtained one or both of the SCRs is defective (either shorted or leaking). For reliability sake, replace both SCRs, or single power pack, based on the existing arrangement.

If after disconnecting the SCRs and re-energizing the control the current and voltage are zero, the SCRs are okay and the problem probably lies within the Interface Unit. Replace the Interface Unit. Be sure not to accidentally swap the SCR1 leads with the SCR2 leads. If they do get switched you will not get any power out of the control when it is re-energized.

If after replacing the Interface Unit the control continues to trip on over current call Redkoh Industries Technical Help at 908/874-5588.

RK2000 Troubleshooting

PROBLEM

SCR Imbalance Trip

COURSE OF ACTION

The SCR imbalance trip initiates when the amplitude of the primary current positive and negative waves differs by more than 20%. This difference could be caused by defective SCRs, defective Interface Unit, or an unequally loaded transformer rectifier set.

Replacing the SCRs is the first step. If this does not solve the problem replace the Interface Unit. If the problem still exists, and you have a double half wave output on the TR operating in the half wave mode, place a full wave jumper between the output bushings. If the imbalance trip continues, follow the TR manufacturer's troubleshooting instructions to determine if the diodes in the bridge rectifier have failed. If the imbalance trips stop with the full wave jumper in place there is a major difference in the loading between the two frames. An internal inspection should be performed.

RK2000 Troubleshooting

PROBLEM

Breaker Trips

COURSE OF ACTION

If the microprocessor control is operating properly it will de-energize the control and display an over correct trip message without tripping the breaker. Therefore, if the breaker is tripping, either the microprocessor Interface Unit is defective and not regulating the conduction angle of the SCRs, one or both of the SCRs are shorted or defective, or there is a short to ground between the breaker and the SCRs.

To eliminate a short to ground in the control cabinet as the problem, disconnect the field wiring going to the primary of the transformer rectifier. Connect four 110 volt incandescent lamps in series across the output of the cabinet. Since the cabinet no longer has a substantial load, re-energizing the cabinet should produce line voltage and very very low current. If moderate or high current is present, a short exists. Keep disconnecting components in-route back to the breaker until the defective device/wiring is found.

If after disconnecting the TR load and the current is zero, the problem probably lies with the SCRs, the Interface Unit, or the breaker. Reconnect the wiring to the TR. Re-energize the control and watch the primary current display. If it goes above the rated current for that cabinet recheck the control programming. If the programming is correct, disconnect each SCR gate and cathode lead from the Interface Unit (tape them individually to keep them from contacting anything). Re-energize the control and again watch the current, it should be zero. If there is any current, or one or more of the SCRs are shorted or leaking. Replace the defective SCR or SCR block.

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If after disconnecting the SCRs the current is zero, the problem lies within the Interface Unit. Replace the Unit with a known working (or new) one.

If after performing all the above checks it is determined that all components are in proper working order yet the breaker continues to trip, replace the breaker. As a double check, place a recording amp meter on the line feed between the breaker and the contactor. If the current does not exceed the control rating, yet the breaker keeps tripping, the breaker is definitely defective.

RK2000 Troubleshooting

PROBLEM

No Primary or Secondary Current (high or rated primary voltage).

COURSE OF ACTION

This condition occurs when there is no load on the control and/or the TR. The first step in determining the cause is to place a temporary ground on the high voltage bushing of the TR. If the TR is a double half wave configuration (two output bushings) make sure the two bushings are tied together for full wave operation.

With a ground on the secondary of the TR the control should reach the primary or secondary current limit programmed into the control, and no voltage. If rated current is present the problem lies in an open circuit between the TR output bushings and the support bushing tie in point for the high voltage frame.

If after grounding the TR high voltage bushing(s) the current is still zero, the problem lies between the control and the output bushings. Verify that the wiring between the TR control and the primary input to the TR is not open. If it is open, replace the defective wiring. If it is not open the problem is within the TR tank.

Megger the primary and secondary of the TR, per the manufacturers instructions. If an open circuit exits on the primary, the TR will have to be removed for repair. If the open is on the secondary, remove and check the full wave diode bridge for an open leg(s). If the diode bridge is open, replace the diode stack and retest. If the current is still zero check the RF coils located between the diode bridge and the output bushing(s) for an open condition. If the no current condition still exists the secondary winding of the transformer core is open and the core will need to be replaced.

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PROBLEM

Low Voltage and Low Current.

COURSE OF ACTION

When both the voltage and current are low it usually means that either excessive sparking is occurring in the precipitator or electrical noise is entering the control cabinet.

Electrical noise can enter the control through the electrical line feed or through the feedback signals from the secondary of the TR.

Usually, the only noise that affects the control through the line feed is fast rise time transients generated by variable frequency drives or SCR type motor speed controls. An Oscilloscope will be necessary to detect these transients. If they are present, adding inductive filters to the feed of the offending motor control will usually solve the problem.

The common entry of noise is through the TR secondary feedback signals. In particular, the secondary current signal. Electrical noise on this line can be interpreted by the control as sparking, and cause the control to back down on power in an effort to maintain a reasonable spark rate.

To check for noise on the secondary current signal, disconnect the lead connected to MA(+)A on TB-5 on the Interface Unit. This will remove both the secondary current signal and the spark signal. Place the control in the manual mode of operation. Slowly raise the power from zero via the manual potentiometer. If the electrical readings hold steady at a level above the level achieved in automatic, then noise is present on the secondary current signal.

If the electrical readings become unstable at about the same levels as when the control was in automatic, then the sparking is real. An inspection of the electrical connections at the TR, within the pipe and guard, and within the precipitator will be required.

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PROBLEM

No Power After Performing Electrical Repairs in Cabinet.

COURSE OF ACTION

This condition occurs most often after SCRs or the control transformer have been replaced. The SCRs are synchronized to line phase. Therefore, if the SCR1 and SCR2 gate and cathode leads get switched or the wiring to the new control transformer get switched, or the new transformer is wound differently, the SCRs will be out of phase and no power will flow.

To fix this problem, either swap the SCR1 and SCR2 gate and cathode leads on TB1 and TB2 of the Interface Unit, or swap the wiring on the secondary of the control transformer.

An out of phase condition can also be detected by placing the display in the conduction angle mode and observing the conduction angle. If the conduction angle is full on (158 degrees) and the control has no power output, both SCRs are out of phase or open circuited.

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PROBLEM

Contactor will not Pull-in, or Pulls-in and Immediately Drops Out when Control is Switched to On - Open Contactor and Stop Mode displayed on message line.

COURSE OF ACTION

This can be caused by either of three failures. One is an open in the cabinet wiring or the contactor coil, another is a defective or poor contactor auxiliary contact, and the third is a defective Interface Unit.

To determine which failure it is, measure the voltage between the "CONTACTOR STATUS" terminal on TB-4 and the 0V terminal on TB-3, on the Interface Unit. With the ON/OFF switch to ON, there should be 120 volts across these terminals.

If 120 volts is not present, start tracing the wire connected to the "CONTACTOR STATUS" terminal back to the contactor aux. contact. If 120 volts is not present at the aux. contact keep tracing back to the fuse. Most likely a wire or connection is open. If the fuse were blown the display on the control would not illuminate. If you get 120 volts at the line side of the aux. contact but not the terminal "CONTACTOR STATUS" side, the contact is dirty or defective.

If 120 volts is present at the "CONTACTOR STATUS" terminal, check the voltage at the "RUN/STOP" terminal. If there is no voltage at the "RUN/STOP" terminal with the ON/OFF switch in the ON position, then the wiring from the switch, or the switch, is defective.

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PROBLEM

No Sparking is Occurring and No Electrical Limit is Being Reached

COURSE OF ACTION

If the control is not under Energy Management Control, not in manual mode, and there is no sparking or arcing, at least one of the electrical parameters should be at a limit. This limit could be one of the ratings of the transformer, or it could be a lower value programmed into the control. Regardless of what the limit is, some limit should be reached. You can tell when a control parameter is at its limit by the little square that illuminates to the upper right of the individual electrical displays.

If a limit is not being reached when there is no sparking, place the display in the conduction angle mode (refer to instruction manual). If the conduction angle is at 158 degrees the current limiting reactor is defective (usually due to shorted turns).

If the control is not operating at 158 degrees the Interface Unit is probably defective. Replace it with a known working unit.

RK2000 Troubleshooting

PROBLEM

Communications Error on the status line of the Device Status Screen and “Comm Fault” on Device Select Screen

COURSE OF ACTION

These communication errors mean that the Keypad and Display Unit is not communicating with the Interface Unit

In order of probable cause: defective Interface Unit, defective communications cable connection, or defective Keypad and Display Unit.

RK2000 Troubleshooting

PROBLEM

Control will not come out of Manual Mode.

COURSE OF ACTION

There are two ways a control can operate in the manual mode. One way is placing the control in manual by throwing the AUTO/MANUAL/STAND ALONE switch located on the bottom of the interface panel into the MANUAL position. The other is the failure of the microprocessor (or other components) on the Interface Unit causing the circuit to automatically switch to the manual mode.

In either case, if the control will not switch back to automatic the Interface Unit is defective and should be replaced.

An indication of a microprocessor failure, on the Interface Unit, is when the CPU RUN indicator stops blinking.