

ENGINEERED SOLUTIONS for MATERIAL HANDLING

Secondary Resistance Controllers (SRC) *for* Wound Rotor Induction Motors



2 x 850kW conveyor SRC.



1250Hp slurry pump SRC with variable speed.

*2 x 800Hp conveyor SRC with
spotting option.*



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Date: September, 2002

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What is It?

THE SECONDARY RESISTIVE CONTROLLER (SRC) is a most reliable and robust controller for various large Wound Rotor Induction Motor (WRIM) industrial applications. The SRC is an engineered product, ideally suited for replacing existing outdated resistive controllers as well as for new materials handling systems which require controlled acceleration, limited inrush current, and the highest reliability attainable. The continuous-duty SRC can also be used for limited speed control applications, with resulting high efficiency with the characteristic SRC reliability.

Requiring little to no maintenance over its 25+ year technological life, the SRC is an obvious drive choice for applications in the most remote locations, and the harshest operating environments. Synergy Engineering Ltd. combines the tried, tested, and true resistive control technology with our expertise in detailed upfront engineering to create the best control of new and existing wound rotor induction motor applications, while using common, non-electronic components:

- PLC of customer's choice
- Special high-speed vacuum contactors
- Cable
- Synergy's proprietary stainless steel power resistors with welded connections
- Interposing relays

Typically supplied for 4kV-18.8kV applications (400Hp and up), due to its unsurpassed reliability, the SRC has been requested for critical applications as low as 250Hp.

Applications include:

- Mills
- Uphill, downhill, overland conveyors
- Crushers
- Wood chippers
- Car shredders
- Fans
- Variable speed pumps
- Automatic load sharing (among multiple drives on a common system)
- Conveyor spotting

How Does It Work?

The Secondary Resistive Controller (SRC) manipulates the wound rotor motor torque-slip characteristic to enable the delivery of the desired torque at the desired speed to control the speed and acceleration of a given load. The SRC can be designed to accelerate a high inertia conveyor softly and smoothly over a few minutes or it can be designed to accelerate a crusher at the highest possible torque (breakdown torque of the motor) repeatedly. Compared to alternate drive options, the SRC has the highest torque per unit of current for motor starting and controlled acceleration. Because motor heating is proportional to I^2 and limits motor and starting capacity, using the SRC results in far less motor heating, and greater motor (and starting) capacity.

The SRC is composed of binary-coded stainless steel resistor grids, vacuum contactors for reliable switching, and a preprogrammed PLC, integrated as a standalone package suitable for indoor or outdoor installation. Synergy intentionally uses components which are common and simple so that the site electrician can

easily trouble-shoot the SRC should a component malfunction. Because of the choice of components, the SRC can be installed in the harshest and dirtiest of environments, while maintaining trouble-free functionality.

Synergy Engineering Ltd. carefully selects the number of vacuum contactors and binary-coded resistors such that the SRC and motor will deliver the desired level of control, smoothness, and torque to a specific application. Typically we design the SRC with 4-9 vacuum starting contactors to provide 16-512 possible acceleration or speed control characteristics to a given driven load. We also design the stainless steel resistor grids such that they are capable of the required torque delivery (current) at the specified speeds, for the calculated time. Our standard design allows for 3-5 consecutive starts with additional starts every 15 minutes, without requiring forced air cooling (no fans).

Through extensive front end engineering, a standalone SRC with a pre-programmed fixed acceleration

sequence specific to the worst-case scenario of its intended application can be supplied. The SRC only requires a customer start signal interlocked with the primary starter.

The SRC is also available with continuous variable

speed and torque control, or with a variable acceleration sequence. For variable control (starting and continuous duty), in addition to the customer-supplied start permissive, the SRC also requires a feedback signal to input the real time load or speed states.

Installation Requirements

Synergy Engineering Ltd.'s vast repertoire of Secondary Resistive Controller (SRC) designs allows us to specialize the physical design of the SRC for any area and any environmental demand. Inherently, the SRC is not sensitive to dust and moisture, making it a versatile drive for the most extreme operating environments. Where reliability and robustness are paramount or where access to the drive location is limited, the SRC is the ideal drive solution.

- ✓ Outdoors
- ✓ Indoors
- ✓ Dusty environment
- ✓ Humid environment
- ✓ High elevation
- ✓ High ambient temperature
- ✓ Low ambient temperature
- ✓ Installation location with reduced access

When possible, Synergy Engineering Ltd. manufactures the SRC as an integrated package for minimal installation time. Typically, the SRC requires only the connection of the Wound Rotor Induction Motor (WRIM) rotor leads to rotor contactor cabinet (RCC), the connection of control power to the RCC, and the connection of the primary interlock to the SRC PLC.

Retrofits and New Systems

Currently, there exist many resistive controllers on Wound Rotor Induction Motors (WRIM) which may be outdated, undocumented, or which may not perform their function reliably or to a desired level of control. Synergy Engineering Ltd. can offer a retrofit Secondary Resistive Controller (SRC) which often has the same or smaller dimensions, but which controls the acceleration of the application to a much higher degree of accuracy, with greater reliability and durability. Our retrofit SRC will improve the system acceleration characteristic and reduce the operating stress on the motor, prolonging

the motor life, while requiring minimal maintenance over the long technological life of our SRC.

Synergy Engineering Ltd. also has extensive experience in supplying entire electrical systems for materials handling applications which have at their heart the SRC and WRIM. For new systems, we offer not only the SRC, but also the WRIM, the primary starters, the system control equipment and programming, field instruments, E-houses, bulks, etc. For new systems, the WRIM and SRC can both be specifically designed for optimum performance for the intended application.

Required Information to Order

Each Secondary Resistive Controller (SRC) is engineered specifically for the application. As such, the following

information is required when ordering your SRC (see *next page*):

Secondary Resistive Controllers (SRC) for Wound Rotor Induction Motors

- WRIM rotor open circuit voltage
- WRIM rotor full load short circuit current
- Load sharing requirements (multiple drives)
- Driven load type (application)
- Number of consecutive starts desired
- Minimum desired starting torque (soft?)
- Torque vs. speed characteristic of the load
- Inertia at the motor rotor shaft
- Degree of control required
- Torque/speed control particulars (for continuous-duty applications only)
- Environmental conditions
- SRC dimensional requirements (if available space is limited)

Summary

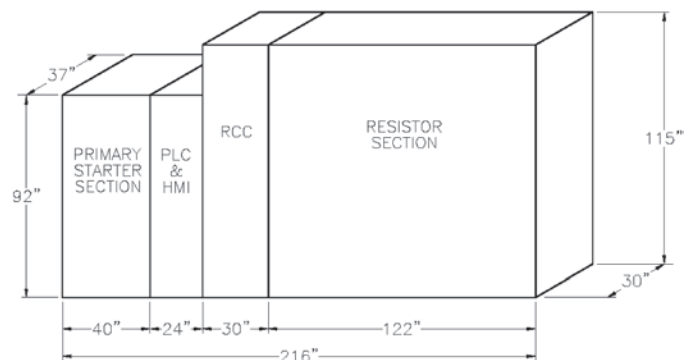
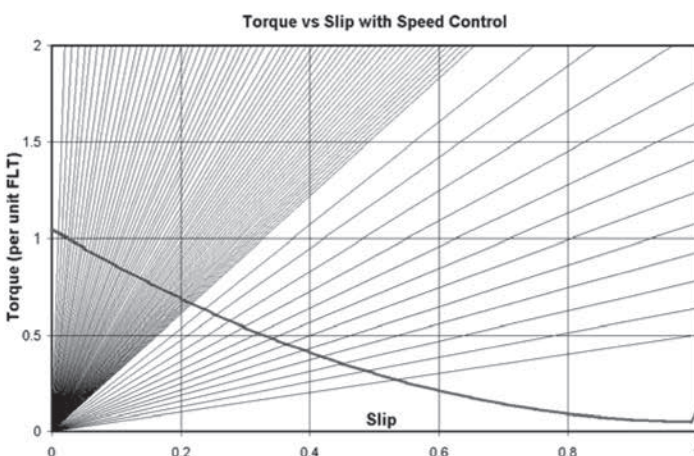
Extensive research and development have moved Synergy Engineering Ltd. to a world-leading position in secondary resistive control for wound rotor induction motor applications. Through our expert knowledge and experience, we can design the SRC to handle the softest and most demanding of controlled-acceleration applications to the harshest and most torque-demanding of applications.

The SRC is completely engineered for each application from the enclosure details right through to the heating

capacity of the stainless steel resistor grids. This high level of specialized engineering combined with the use of common electronics-free components makes for a trouble free, maintainable, robust and reliable drive. Synergy Engineering Ltd. is committed to supporting each and every customer worldwide—with zero failures to date we back our drive with a 2-year warranty. After-sales service requests are rarely required after the commissioning phase.

Example of 1250Hp Slurry Pump SRC with Variable Speed (picture on first page)

- Slurry pumping application for mine (replaced VFD)
- 13.8kV 1250Hp WRIM application
- Primary section included with SF6 breaker
- 50% minimum starting torque
- Speed control range: 67.5% - 100%
- 64 steps for speed adjustment in ~0.25-0.5% increments

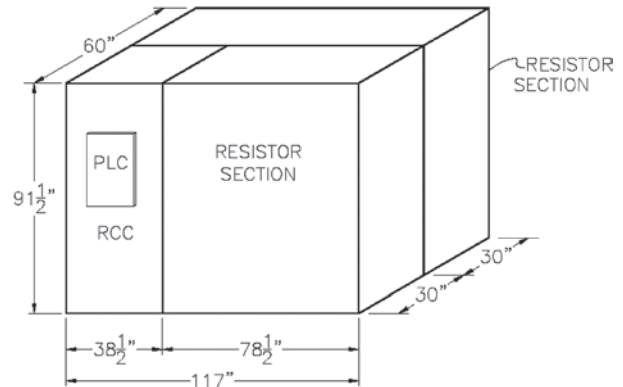
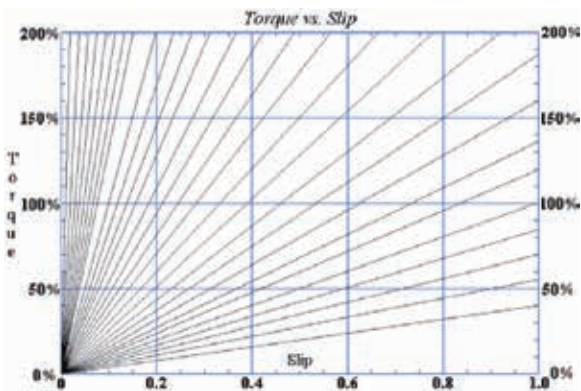


- 9 vacuum contactors total (512 characteristics available)
- 6/9 vacuum contactors used for continuous speed control
- Dedicated pre-programmed PLC with analog inputs
- Integrated HMI in PLC door for manual user interface
- Top entry of rotor cables (2x750mcm per phase)
- 5 consecutive starts available (7-8 per hour)
- Motor breakdown torque delivery available (250%)

Secondary Resistive Controllers (SRC) for Wound Rotor Induction Motors

Example of 2 x 850kW Conveyor SRC (picture on first page)

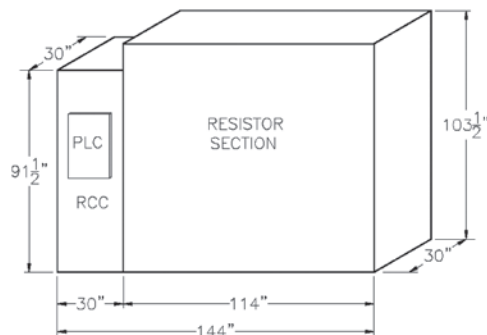
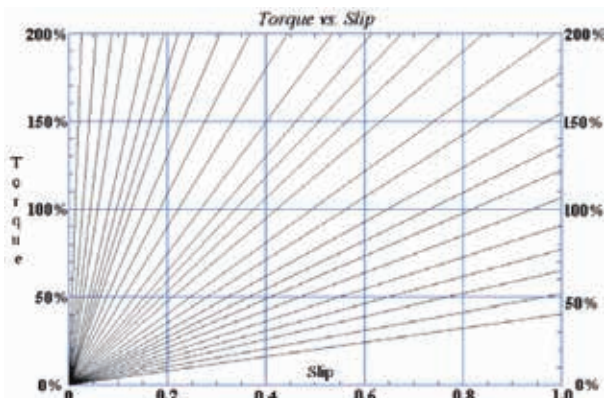
- Overland conveyor application (replaced fluid couplings)
- 2 x 850kW application @3200 m.a.s.l.
- Outdoor (dry and dusty) installation
- 40% minimum starting torque
- 8 vacuum contactors for starting
- 256 characteristics available for acceleration



- 28 chosen acceleration steps over 68 seconds
- 1 integrated PLC in RCC door to control pair of 850kW SRC
- Bottom entry of rotor cables
- 3 consecutive starts available (5-6 per hour)
- Manually adjustable trimming resistor for load sharing
- Installation and commissioning time: less than 1 day

Example of 2 x 600-800Hp Conveyor SRC with Spotting Option (picture on first page)

- Overland conveyor application (replaced fluid couplings)
- 2 x 600-800Hp SRC @4000 m.a.s.l.
- Outdoor (wet and dirty) installation @100% humidity
- 40% minimum starting torque
- 7 vacuum contactors for starting



- 128 characteristics available for acceleration
- 27 chosen acceleration steps over 67.5 seconds
- 1 integrated PLC in RCC door to control pair of SRC
- Bottom entry of rotor cables (2x750mcm per phase)
- 3 consecutive starts available (5-6 per hour)
- Manually adjustable trimming resistor for load sharing
- Spotting: ~15-20% speed for 90 seconds for belt splicing and maintenance requirements



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