

SELECTRONICS

Innovative Solutions Through Electronic Technology

MULTIFUNCTION WINDER CONTROLLER System Model MWC

The MWC is a microprocessor-based control system for yarn take-up winders such as the Leesona 968 series (and others). It provides precise, programmable and intelligent control of all winding parameters to enhance the winder's performance and provide the winding engineer with a tool that enables an infinite number of possible combinations of the factors that determine package formation and winder operation. Control of the multiple functions of the winder provides the flexibility to optimize the winding process for a variety of yarn deniers and styles, process speeds and package dimensions while remaining within the electrical and mechanical limitations of the winder.

Significant quantifiable benefits may be realized by implementation of the MWC system such as:

- Greatly improved package appearance, conformity and consistency
- Greater process and winding speed capability for increased production rate
- Greater package density gives more yarn per package of same diameter
- Greater package stability, less shifting or deformation during shipping and handling
- Improved winder repeatability per position and reduced position-to-position variations
- Improved thread-up due to extremely accurate "preset" speed control
- Metered-length yielding consistent package measure
- Improved yield through reduced winding waste, deformed tails, poor first-wraps, etc.
- Reduced influence of environmental climate on winding performance
- Reduced tension "impulse" spiking caused by traverse action
- Faster package unspooling capability and more consistent unspooling performance
- Improved winder efficiency, less power consumption and fewer winder-caused breakouts
- Improved operator efficiency by tighter control over winder operation at doff and string-up
- Reduction in winder component wear translating to less maintenance

These are some of the benefits that have been realized by customers using the MWC since 1992. To accomplish full control over winding the MWC monitors and optimizes these factors:

1. **PRESET SPEED** Precise programmable spindle preset speed regulation assures consistent string-up performance and eliminates the need for constant re-calibration due to drift. The preset speed for all positions is slaved to the to the process speed by the auto-preset that "sync-locks" to the delivery roll drive motor. Thus the preset automatically follows changes with no reprogramming necessary for product change. Or instead, a master control may be used to manually set the preset speed for all positions simultaneously.
2. **TENSION
CONSISTENCY** The patented Selectronics RSC (Regulated Set-point Convergence) provides precise spindle speed and torque regulation in response to compensator arm position. This minimizes the normal traverse-induced tension spikes to provide uniform tension, which contributes greatly to the proper formation of each package.

3. TENSION CONTROL
The yarn winding tension may be programmed to follow a tapering profile as the package builds to improve package stability and density. The MWC controls the analog electrical command reference to a proportional air pressure regulator, which feeds a pneumatic linear actuator that applies pull-down force on the compensator arm.
4. COMPACTION CONTROL
The spindle-to-roller bail pressure may be programmed to follow a tapering profile as the package builds to improve package stability and density. The MWC controls the analog electrical command reference to a proportional air pressure regulator, which feeds a pneumatic linear actuator that applies frame-in force to the winder carriage.
5. RATIO CONTROL
The traverse-to-spindle wind ratio is normally fixed by the belt linkage between the spindle and the traverse cam. The MWC system utilizes a separate motor to drive the cam and then controls its angular position precisely in step with the spindle, as if it were belt-driven, but now with the flexibility to continuously control the helix angle of the yarn as it is applied to the spindle. Thus, the wind ratio may be changed at will to a fixed value or step-changed as the package builds to allow optimization of the package geometry for improved density and stability.
6. METERED LENGTH
The MWC provides control of automatic cut, aspirate and stop actions after the package reaches the programmed linear measure to assure consistent yarn measure for each package.
7. ARM HOLD-DOWN
During thread-up the compensator arm is held against the bottom rail with high force to prevent the yarn string-up process from the lifting arm prematurely. This aids in string-up performance.
8. PRESET ALERT
An attention-getting light may be mounted at each position to indicate when spindle has reached preset speed for operator cueing to prevent unsuccessful thread-up due to premature yarn presentation.
9. TAIL TRANSFER
Automatic transfer from tail-wind to traverse-wind (if used) assures precise, consistent tail lengths. The MWC provides control of the tail transfer action.
10. OPERATOR ALERT
The operator alert light mounted at each position indicates: "almost-ready-to-doff", "full-package-stop", "incomplete package stop" and "fault-stop" (break-out, etc.).
11. MEASURE MONITOR
The total measure wound on the package is stored in memory and may be read by the host or displayed by the Keypad Display Unit to verify contents of full or partial packages.
12. SEQUENCING
The MWC's timing and control logic for automatic thread-up (if used) and automatic doffing (if used) provides the sequencing of any ancillary devices to effect such functions as tube grip and release, cut, waste, aspirate, spindle braking, full package push-out, etc.
13. HOST COMMUNICATION
RS-422/RS-485 data may be exchanged between each MWC board and any "host" PLC, computer, SCADA or Distributive Control System. This allows parameter "recipe" programming for quick style changes, monitoring of winding process. It also allows the interrogation of the board for the stored historical data such as package length, the number of complete packages, the number of incomplete packages, winder "downtime" (time between doffs), etc.
14. PORTABLE COMMUNICATOR
A port is provided on each plug-in board for temporary connection of a Keypad Display Unit which can be used to monitor winder operation, check and modify program parameters, and provide for easy testing and set-up of individual units in place of or in the absence of host control.
15. AUTONOMY
Once the "recipe" of parameters for a style is programmed into a MWC board it then will function completely independently of the host PC, PLC or SCADA system. Communication between the MWC and the host is only necessary for style change. In fact, the Keypad Display Unit can download parameters so a host connection is not necessary at all.
15. RELIABILITY
Non-contact compensator arm position sensing and solid-state logic circuitry insures dependable long life for all elements. Plug-in circuit boards allow quick change for minimum downtime should a board replacement be necessary. The MWC system has been used widely since 1992 with less than one per cent of units ever requiring service. The MWC board is GUARANTEED free from defects in materials and workmanship for FIVE-YEARS!

SYSTEM ELEMENTS

MWC board The Multifunction Winder Controller main circuit board is the heart of the system. It contains the input signal processors, microcomputer, logic circuitry, output and switching circuitry for performing all of the start, wind and doff functions. Each board controls one winder position.



Its functions include:

1. **Receive the parameter** programming data from the host and **store** it in non-volatile E² PROM memory for:
 - the tension start, stop and ramp values
 - the compaction start, stop and ramp values
 - the warning measure value
 - the full package measure value
 - the tail transfer measure (if used)
 - and, up to 24 ratio-step-changes-per cycle
2. **Receive the closure signal** from the start switch and **sequence** the starting functions by relay contact switching to effect: brake release, package grip, both motors start, frame-in and arm hold-down.
3. **Receive the preset** pilot frequency and **sync-lock the spindle** while in preset mode.
4. Detect thread-up and **wind the proper length tail** then effect **yarn transfer** to traverse winding by relay contact switching.
5. **Process the arm position** reference input by applying PID and RSC^R to produce a reference for the spindle's DC motor drive to accurately control the spindle torque to **minimize tension spikes**.
6. Convert the **compaction control** value stored in memory to a 4-20 mA reference for the compaction air pressure regulator.
7. Convert the **tension control** value stored in memory to a 4-20 mA reference for the tension air pressure regulator.
8. **Taper the pressure and tension** references as the package builds according to the stored profile.
9. Process the pulses from the spindle motor's tachometer pickup and by using the ratio value stored in memory to **produce a pilot reference** pulse train for the traverse control.

10. Process the pulses from the traverse motor's encoder and **provide a speed reference** to the traverse drive to **sync-lock the two motors** and accomplish perfect numerical ratio precision between the two.
11. **Totalize the accumulated linear measure** on the package and when each stored step-change value is reached effect a ratio change.
12. At the appropriate times provide a contact closure output to **illuminate the alert light** for status indications.
13. When the total measure for full package is reached or the stop circuit opens then **sequence the doffing functions** by relay contact switching to provide: exhaust, cut, aspirate, braking, frame-out, release and package push-out.

CARD CAGE A metal frame with printed-circuit card edge guides and plug-in connectors is used to secure multiple MWC boards in a convenient and protected area, usually remote from the winder location. This facilitates a quick board change to minimize down time should servicing be necessary.



KDU The Keypad Display Unit plugs directly onto any MWC board to access all parameters and memory functions for viewing or altering. This is helpful in ratio, tension and compaction development and testing of selected positions that may be temporarily removed from host control. It also may be used in case of failure of the host or its communications ability.



- SOFTWARE** Programming software for the MWC is provided in a non-volatile E² PROM that resides on the MWC board. The system is supplied with the software that provides the functions stated here in.
- FRC** The Frequency Reference Converter samples the motor voltage that drives the delivery roll and determines its frequency. It then processes this frequency with programmed multiplication and division constants and derives an output frequency that serves as a pilot preset reference for all the winder positions fed by that delivery drive. This pilot is then used by each position to sync-lock the preset for ultra-accurate regulation that automatically responds to delivery roll speed changes.
- IPS** The inductive proximity sensor serves as a tachometer pickup to measure the spindle speed and angular position. It is used with an existing or customer-provided gear or wheel mounted on the spindle drive train. Information from this sensor is used in control of Preset speed and in the syncing of the traverse cam to the spindle.
- MAS** The Magnetic Angle Sensor replaces the old-style transducer. It offers extremely high reliability because it makes no contact with any moving parts thus any wear or mechanical problems are not possible. The MAS is mounted stationary and senses the position of the compensator arm by measuring the relative angle of the magnetic field produced by a small magnet mounted on the arm shaft. The arm position is then converted to a voltage reference signal that is transmitted to the MWC main board where it is processed and used to control the spindle torque.
- DMA** The Dancer Magnet Assembly is an aluminum collar that fits over the bell crank on the compensator arm shaft. On the end of the collar a small bar magnet is attached. The collar is positioned on the bell crank and secured with a setscrew so that the magnet is perpendicular to the end of the MAS case when the arm is in the desired running position. This is a one-time alignment and requires no further adjustment throughout the life of the system.

OTHER REQUIRED ELEMENTS (supplied by customer OR by Selectronics)

Additional elements are required to implement the system and functions stated above. Some or all of these may already be in place in an existing winder application. If they are not then Selectronics can provide them along with the MWC system. They are:

- spindle motor
- spindle motor drive
- traverse motor
- traverse motor drive
- pneumatic valves
- pneumatic regulators
- pneumatic actuators
- power supplies for any of these elements
- operator's start/stop station
- alert light
- interconnecting wiring and tubing
- mounting brackets

Warranty – FIVE YEARS !!