

**Specifications
for
Tucor Flowmaster TWC- 50/100/200 (C)
Control System**

GENERAL:

The Automatic Sprinkler System Controls shall be the TUCOR Flowmaster TWC-50/100/200 (C) Control system, as hereinafter specified and as shown on the drawings.

The system shall include the TWC 50/100/200 (C) controller Modem (optional), the LTB-100 Line Termination Box, Optical Coupler, Line Decoders, PD-100 Pump Decoder (optional), Field Access Unit with Outlets (optional), Remote Access Software, Remote Monitoring Software (optional), SD-100 Sensor Decoder, (optional), field wiring, surge protection and all other equipment required for a complete system and as hereinafter specified.

The TWC-50/100/200 (C) shall be a stand-alone controller and shall have the possibility to be operated remotely from another TWC-50/100/200 (C) or from a PC with the Remote Access software. The remote operation may be via a serial cable or modem/telephone line. The serial communication cable shall have a built-in optical isolator which shall offer a complete protection against surges up to 2500 V.

The controller must be specified as the (C) version, i.e. TWC-100-C to include the internal modem and communications package.

The TWC-50/100/200 (C) shall be capable of logging every action in the system (opening and closing of valves, start/stop of schedules, sensor actions, power failure etc.) to a maximum of 10,000 actions. When the TWC-50/100/200 (C) is accessed from a PC directly (see COM Specs), the TWC-50/100/200 (C) shall upload the complete log to the PC.

The controller shall be capable of integrating into it a maximum of two (2) sensors for control of the system or for some other action to take place. Sensors may be such types as a rain shut-down sensor, an alarm sensor, etc.

The controller shall support the use of a sensor decoder connected directly to the two-wire path. The sensor decoder shall support the use of a flow meter (pulse or 4-20 mA) and the controller software shall log the flow measurements. On excess, the software shall stop the active stations and shall attempt to continue irrigation according to the active irrigation schedule. If the controller is in the active mode the flow sensor shall trigger an alarm that will activate/deactivate the master valve circuit, should flow be detected prior to start of any active schedule.

The controller shall include a special circuit for monitoring, on a continuous basis, the line voltage condition to assure that the mean voltage relative to the ground is slightly negative. Thus, if this condition is changed, due to a leakage in the system, etc. the communication lines shall be automatically disconnected from the central unit. The system shall include a special circuit for monitoring on a continuous basis, the line voltage to be maintained within certain limits. Thus, if this condition is changed due to a short in the system etc., the communication lines shall be automatically disconnected from the central unit.

The controller shall come in three versions: The TWC-50 for individual control of up to 50 valves, the TWC-100 for up to 100 valves and the TWC-200 for up to 200 valves. It shall be possible to upgrade TWC-50 to the TWC-100 and the TWC-100 to the TWC-200.

The TWC-50/100/200 (C) shall be capable of managing a maximum of 50/100/200 Line Decoders operating a maximum of 10 solenoids at a time. Each LD-100 and LD-200 shall be capable of operating 2 solenoids

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whereas the LD-400 (4 outputs) and LD-600 (6 outputs) shall be capable of operating 1 solenoid independently on each output.

The TWC-50/100/200 (C) shall be capable of managing a maximum of 5 schedules at any one time. Each of the 5 schedules can have up to 6 independent start times per day. The scheduling for each program, shall be on 14 or 15 day irrigation cycle allowing operation to occur on any or all of the 14 or 15 days.

Each of the 5 schedules shall be capable of independently being water budgeted from 0% to 300% in 1% increments to accommodate adjustment for daily climatic changes, etc.

The TWC-50/100/200 (C) shall display total and remaining run times and shall give a warning for mistakes in programming like overlapping schedules, missing start times, etc.

The TWC-50/100/200 (C) shall provide the possibility to program schedules either for day and time start or for a link-start with first the schedule being the master schedule and the rest being linked to the master thus avoiding overlapping when water budgeting.

The TWC-50/100/200 (C) shall provide two modes of operation: Automatic or Manual. In the Automatic mode the TWC shall carry out active schedules as programmed. In the Manual mode it shall be possible to turn on any of the 50 (100) valves for 1-999 minutes up to the system capacity of 10 solenoids.

Programming shall be done in a maximum of 60 steps each of a maximum of 999 minutes, which shall allow for repetition of a certain valve (cycle and soak) or pauses "between" steps.

The Remote Access Software TWC-RAS shall allow remote access to one controller from a PC for schedule management and manual control.

The Remote Monitoring Software TWC-RMS (optional) shall allow storing of up to 25 phone numbers (Phone Book) to be selected for access via the telephone network for control and uploading of logged data. The Remote Monitoring software shall allow for scheduling of "calls" to the 25 addresses in the Phone Book. The uploaded logged data shall be stored in a file on the PC's hard disk.)

LINE TERMINATION BOX:

Furnish and install, for connection of the field 2-wire communication paths to the Controller, a TUCOR LTB-100 Line Termination Box. This Line Termination Box shall provide for Surge Protection on the 2-Wire Communication wires to prevent surges coming from the field wires back to the controller. In addition to facilitating connection of the 2-Wire Communication wires to the Computer it shall also provide for connection of the Sensor Devices into the system. The Line Termination Box shall provide terminals for connecting up to two (2) 2-Wire communication paths. The Line Termination Box shall be mounted near the Controller, where shown on the drawings and/or where directed. It is recommended to mount the LTB on the exterior closest to the ground network. Install a #12, or larger, bare copper grounding wire from the ground terminal in the line termination box to a ground rod, as specified under Surge Protection and Grounding, of this specification.

LINE DECODERS:

Furnish and install, where shown on the drawings, TUCOR Line Decoders, LD-100, LD-200, LD-400 or LD-600, for interfacing between the communication 2-Wire path and the remote control valves of the sprinklers. The decoders shall be completely Epoxy sealed for complete water proofing. Each decoder shall have "built-in" surge protection as an integral part of the basic decoder. The decoder shall have two (2) blue colored wires for connection onto the 2-Wire Communication path and two (2) white colored wires for connection to the solenoid of the remote control valve. Each decoder shall be clearly marked with a three (3), four (4) or five (5) digit number indicating the number (address) that it has been set to respond to. Decoders may be installed in any random order desired.

The output of the decoder shall be 24 VAC. Each LD-100 decoder shall be capable of operating a maximum of Two (2) Solenoids (24 VAC, 2W). The secondary wiring, from the first solenoid to the second solenoid, when two (2) solenoids are being powered and controlled from one decoder - shall be Size #14, TUCOR wire as hereinafter specified.

The contractor shall be responsible for accurately recording on the drawings, as each decoder is being installed, the address number of the decoder at that location. It is also necessary that it be indicated which remote control valves are being controlled by each specified decoder. In this way he will have the necessary information when he is ready to input the system installation data.

Where the decoder are activating and controlling individual remote control valves, the valve and the decoder shall be installed in a standard plastic valve box of sufficient size to provide easy and necessary access to service the valve and decoder.

PUMP DECODERS: (Optional)

Furnish and install a TUCOR PD-100 Pump Decoder for each of the pumps on the system, including any Booster pumps, for interfacing between the communication 2-Wire path and the pump main motor starter holding coil relay.

FIELD ACCESS UNIT: (Optional)

Furnish a TUCOR FA-100 Portable Field Access Unit for manual operation of decoders from remote locations in the field. It shall be possible to "Plug" the Portable Field Access Unit into the 2-Wire Communication path and by keying in the proper decoder identification - have the central computer "turn on" or "turn off" the designated decoder. It shall be possible to turn on decoders in any order desired, any where on the system, for a length of time from 1 to 999 minutes for each to operate and to have as many in operation at one time (up to a maximum of 10 solenoids/decoders total) as may be desired.

FIELD ACCESS UNIT CONNECTION BOX: (Option)

Furnish and install, where shown on the drawings and/or where directed, a TUCOR FAB-100 Field Access Unit Connection box assembly. The box shall be of molded plastic (5" x 5" x 2 1/4" deep) with coin operated latch for the hinged cover. A 1/2" cable gland shall be provided at the bottom for connection of the 2-Wire Communication path to the Plug-In Socket housed in the box on a stainless steel bracket.

Each Field Transmitter Connection Box shall be securely mounted on a 4" x 4" treated and painted wood post, which is securely anchored on a 12" x 12" x 8" deep poured concrete base. The Connection Box shall be approximately 42" above the finish grade. A 1/2" conduit shall be run from below grade, up through the concrete base and attached to the bottom of the transmitter connection box, through which the 2-Wire Communication Wire shall be run up to the box and connected to the socket in the box.

2-WIRE COMMUNICATION PATHS:

All wire required for the 2-wire Communication Paths, from the Line Termination Box, at the central computer location out to the various field decoders shall be double jacketed two (2) conductor cable specially designed for use with the TUCOR Flowmaster control systems. The cable shall be suitable for direct burial and may also be installed in ducts or conduits.

The conductors shall be tin coated, soft drawn, annealed, solid copper conforming to ASTM 33 with 4/64" thick PVC (polyvinyl chloride) insulation, conforming to UL Standard #493 for thermoplastic-insulated style UF (Underground Feeder), rated at 60 degree C.

The two insulated conductors shall be laid in parallel and encased in a single outer jacket of 3/64" thick, high density, sunlight resistant Polyethylene conforming to ICEA S-61-402 and NEMA WC5, having a minimum wall thickness of .045". The outer jacket shall be pressure extruded so as to completely fill the interstices between the two insulated wires, or may have Tube Jacketing to form an envelope over the two insulated UF conductors lying in parallel, at the discretion of the manufacturer.

The two conductors shall be color coded with one conductor black and the other red. Both conductors shall be the SAME SIZE and shall be of sizes as required for the proper operation of the Field Decoders and solenoids and/or as called for on the drawings.

All splices and connections in this wiring shall be made using either 3M, DBY (direct burial), 82A1 epoxy wire connector kits. Any other type of wire connectors will NOT be acceptable. Care shall be taken with each wire joint or connection to assure that a completely good, waterproof connection will result. It is important that ALL wire connections be ABSOLUTELY watertight and with NO LEAKAGE TO GROUND nor any shorting from one conductor to the other.

The Grounding Network at the controller shall measure not more than 15 OHMS when measured with a Vibra-Ground, or similar type instrument. It will greatly increase the effectiveness of the Surge Protection Equipment, if the grounding grid network can be 5 OHMS or less. It is extremely important that a good ground be maintained for the surge Arrestors to be effective and periodic testing is recommended, to assure that you do have a good grounding system at all times.

The system shall be capable of using existing multi-wired control circuits by converting them into a two-wire layout utilizing the SCB-100 Conversion Terminal.

SYSTEM CONVERSION:

The controller shall be capable of using existing multi-wired control circuits by converting them into a two-wire layout utilizing the SC 25/50 Conversion Terminal. Decoder shall then be added to all valve locations.

The controller shall be capable of using existing multi-wire circuits by converting the two wire output to multi-wire by utilizing the CAM-25 controller adapter module.

SURGE PROTECTION - GENERAL:

All Surge Protection, Grounding and Installation of equipment, therefore specified, shall be installed in strict compliance with the manufacturer's recommendations and in accordance with Local, State and Federal codes and requirements.

PRIMARY POWER SURGE PROTECTION:

Furnish and install on the Power Circuit, furnishing power to the power transformer a surge arrester.

FIELD SURGE PROTECTION:

Surge protection SP-100 shall be installed at every line termination point. Additional installation of SP-100's are needed per 600 feet of wire cable, located at the nearest line decoder. The SP-100 ground wires shall be connected to a single 8 foot ground rod. If the valve is metallic or the solenoid valve has a metallic center pin, one SP-100 ground wire shall be connected to this. The LD-400 and LD-600 contain a LSP within and must be grounded.

The ground shall measure 50 OHMS or less.