

RS485 COMMUNICATION CLOCK SYSTEM

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS & SCOPE

- A. Furnish and install a complete new clock system using Sapling, Inc. RS485 Communication clock system.
- B. All bids shall be based on the equipment as specified herein. The catalog numbers and model designations are that of Sapling, Inc. The specifying authority must approve any alternate system.
- C. Bidders wishing to submit alternate equipment shall submit to the specifying authority, at least ten (10) days prior to bid opening, the equipment proposed to provide a precise functional equivalent system to meet specifications. Bidder shall provide adequate information prior to bid date such as specification sheets, working drawings, shop drawings, and a demonstration of the system. Alternate supplier-contractor must also provide a list to include six (6) installations of the identical system proposed which have been in operation for a period of two (2) years.
- D. Final approval of the alternate system shall be determined at the time of job completion. Failure to provide the "precise functional equivalent" shall result in the removal of the alternate system at the contractor's expense.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract apply to this Section.
- B. Requirements of the following apply to this Section:
 - 1. Basic Electrical Requirements
 - 2. Basic Electrical Materials and Methods

1.3 SUMMARY

- A. This Section addresses the needs and requirements of the RS485 Communication system. It includes requirements for the RS485 Communication clock system components including, but not limited to, the following:
 - 1. Master Clock
 - 2. Secondary Analog Clock
 - 3. Secondary Digital Clock

1.4 SYSTEM DESCRIPTION

General: Furnish and install all equipment, accessories, and materials in accordance with these specifications and drawings to provide a complete and operating RS485 Communication system.

1.5 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract Sections:
 - 1. Submit equipment prints, full electronic wiring diagrams and specification sheets for each item specified herein. Provide a tabulation of the specification clearly comparing the submitted item with the specified item, being able to refer to all written expressed functions and capabilities. Specification sheets shall be submitted on all items.
 - 2. Wiring diagrams, detailing wiring for power and control.
 - 3. Submit wiring diagrams showing typical connections for all equipment.
 - 4. Submit a certificate of completion of installation and service training.

1.6 QUALITY ASSURANCE

- A. All items of equipment shall be designed by the manufacturer to function as a complete system and shall be accompanied by the manufacturer's complete service notes and drawings detailing all interconnections.

- B. The contractor shall be an established communications and electronics contractor that has had and currently maintains a locally run and operated business for at least three (3) years. The contractor shall utilize a duly authorized distributor of the equipment supplied for this project location with full manufacturer's warranty privileges.
- C. The contractor shall show satisfactory evidence, upon request, that the supplier maintains a fully equipped service organization capable of furnishing adequate inspection and service to the system. The supplier shall maintain at his facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.
- D. Electrical Component Standard: Provide work complying with applicable requirements of NFPA 70 "National Electrical Code" including, but not limited to:
 - 1. Article 250, Grounding.
 - 2. Article 300, Part A. Wiring Method.
 - 3. Article 310, Conductors for General Wiring.
 - 4. Article 725, Remote Control, Signal Circuits.
 - 5. Article 800, Communication Systems.
- E. Installation and start up of all systems shall be under the direct supervision of a local agency regularly engaged in installation, repair, and maintenance of such systems. The supplier shall be accredited by the proposed equipment manufacturers.
- F. The agency providing equipment shall be responsible for providing all specified equipment and mentioned services for all equipment as specified herein. The agency must be a local authorized distributor of all specified equipment for single source of responsibility and shall provide documents proving such. The agency must provide written proof that the agency is adequately staffed with factory-trained technicians for all of the specified equipment. The agency must have established business for and currently be providing all services for the equipment.
- G. The contractor shall guarantee availability of local service by factory-trained personnel of all specified equipment from an authorized distributor of all equipment specified under this section. Maintenance shall be provided at no cost to the purchaser for a period of one (1) year (parts and labor) from date of acceptance unless damage or failure is caused by misuse, abuse, neglect, or accident.
- H. The contractor shall, at the owner's request, make available a service contract offering continuing factory authorized service of the system after the initial warranty period.
- I. The supplier shall visit the sites and familiarize himself with the existing conditions and field requirements prior to submitting a proposal.
- J. The contractor is responsible for all costs associated with proper installation, termination, configuration, programming, impedance and load matching of all system components.
- K. The contractor shall provide all necessary masonry, covering, patching, and painting work in order to render any residue of the existing central equipment invisible. All finished surfaces shall be chosen in consultation with the Owner, to assure that the Owner's aesthetic preferences have been adhered to.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in factory boxes. Store in clean, dry space in original boxes. Protect products from fumes and construction traffic. Handle carefully to avoid damage.

1.8 IN-SERVICE TRAINING

- A. The contractor shall provide training with this system. These sessions shall be broken into segments that will facilitate the training of individuals in the operation of this system. Operators Manuals and Users Guides shall be provided at the time of this training.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. The manufacturer shall be:

Sapling, Inc.
1633 Republic Road
Huntingdon Valley, PA 19006
Phone: 215.322.6063
Fax: 215.322.8498
Web: www.Sapling-Inc.com

- B. The clock system shall be a RS485 Communication system.
- C. The intent of this specification is to establish a standard of quality, function, and features. It is the responsibility of the bidder to insure that the proposed product meets or exceeds every standard set forth in these specifications.
- D. The functions and features specified are vital to the operation of this facility, therefore, the acceptance of alternate manufacturers does not release the contractor from strict compliance with the requirements of this specification.
- E. The Contractor for this work shall be held to have read all of the Bidding Requirements, the General Requirements, and Contract Proposal Forms; and in the execution of this work, he will be bound by all of the conditions and requirements therein.
- F. The contractor shall be responsible for providing a complete functional system including all necessary components whether included in this specification or not.
- G. In preparing the bid, the bidder should consider the following:
 - 1. No claim will be made against the owner for any costs incurred by the bidder for any equipment demonstrations which the owner requests.
- H. Any prior approval of an alternate system does not automatically exempt the supplier from meeting the intent of these specifications. Failure to comply with operational and functional intent of these specifications may result in the total removal of the alternate system at the expense of the contractor.
- I. Alternate equipment shall be considered if submitted to the specifying authority at least ten (10) days prior to bid date. Submission of an alternate shall contain an original draft point by point comparison of the submitted product relative to the requirements of this specification sheet covering all components of the system as well as all items of Section 1 "SUBMITTALS". The system and equipment drawings and specifications sheet shall meet all items of the specification.
- J. Proposed alternate equipment shall be accompanied by a letter from the manufacturer clearly stating that they have read the specifications, have listed differences between their product and the specified product, and commit to meet or exceed the specified requirements herein.
- K. All proposed alternate systems must comply with section 2.1, letters H and I above. Submissions failing to comply with the aforementioned requirement shall be deemed as non-compliant.

2.2 SYSTEM REQUIREMENTS

- A. Analog and/or digital clock system with interface capability to GPS, network and the Internet.

2.3 SYSTEM

- A. The system can work in conjunction with existing wiring and the system shall have interface capability to GPS, network, and the Internet.
- B. The system shall be designed to work in an environment where a low or high voltage system is desired. This system will correct the clocks immediately upon receipt of the digital signal.
- C. Each clock in the system shall be capable of receiving the RS485 signal. The master clock will transmit the signal to the clock and every clock thereafter will receive and transmit the signal to one another.
- D. The analog and digital clock, while receiving a RS485 signal, shall automatically correct itself.
- E. The analog clock shall have a built-in close-loop system that will allow the clock to detect the position of the hands and bring the clock to the right time, even if the clock were manually altered.
- F. The analog clock shall have the capability for diagnostic function that will allow the user to view how long since the clock received a signal, as well as functional tests of the electronics and gears.

3.0 PRODUCT

- A. Master Clocks

The master clock shall be the SMA 2000 or 3000 series Master Clock or the SBD 2000 series digital clock. Please choose from one of the following master clocks:

1. The Master Clock shall be the Sapling SMA 3000 Series. The master clock shall have a LED display, as well as a backlit, two row by twenty character LCD display. The master clock shall have the capability of receiving time from any SNTP (Simple Network Time Protocol) server. The master clock shall have up to ten pre-programmed SNTP addresses in case the clock does not receive its time from one of the servers, a backup is in place. The master clock will be capable of receiving signals from all Sapling Master Clocks via RS485, as well as 59 minute correction, 58 minute correction, National Time and Rauland, and Dukane. The master clock shall have the capability of running a wired system and/or wireless system (with transmitter option). The master clock shall contain two clock circuits that have the capability to run synchronous wire systems such as 59 minute correction, 58 minute correction, National Time/Rauland or a once a day pulse for intercom systems. The master clock shall be programmed via the 16 button rubber tactile keypad. The master clock shall be powered by 110VAC/60 Hz or 220VAC/50 Hz. The master clock is pending FCC approval.

SMA 3000 upgrade options

Transmitter Option - The transmitter shall be capable of transmitting data to the SAL wireless analog clock and the SBL wireless digital clock. The master clock shall be capable of receiving a signal from any SNTP time server via the Internet. The transmitter shall utilize 915–928 MHz frequency–hopping technology. The master clock shall be capable of acting as a repeater while receiving a signal wired or wirelessly from the main master clock.

Optional Relays (zones) - The master clock shall be capable of utilizing four or eight zones that can be used for bell scheduling, lights, etc. The zones shall be capable of being programmed via the 16 button rubber tactile keypad and LCD display or from the web interface upgrade.

GPS – The master clock shall have the option of having a GPS receiver built into the unit for synchronization from the satellites via UTC. The antenna shall be roof mounted using the supplied 75 foot cable.

Web Interface – The master clock shall be able to be programmed completely from a web interface that can be accessed through any typical web browser such as Microsoft Internet Explorer or Mozilla FireFox. The interface shall allow the user to program all bell schedules, events, display features, IP settings of the master clock and any system setting that the master clock has.

SNTP Server – The master clock shall have the capability to act as a SNTP server that other devices can point to in order to receive the time through SNTP protocol.

Countdown for Digital Clocks – The master clock shall be able to set the countdown time between events and have the digital clocks countdown (ex. Time will count down between classes in schools or breaks in a factory)

2. The Master Clock shall be the Sapling SMA 2000 Series. The master clock shall have a LED display and two push switches. The master clock shall be capable of receiving a signal from any SNTP time server via the Internet. The master clock shall have up to ten pre-programmed SNTP servers to use in case the clock does not receive time from one of the servers via a web interface. The master clock will be capable of receiving signals from all Sapling Master Clocks via RS485, as well as 59 minute correction, 58 minute correction, National Time and Rauland, and Dukane. The master clock shall have the capability of running a wired system and/or wireless system (with transmitter option). The master clock shall contain two clock circuits that have the capability to run synchronous wire systems such as 59 minute correction, 58 minute correction, National Time/Rauland or a once a day pulse for intercom systems. The master clock shall be programmed via the two push switches on the front panel. The master clock shall be capable of interfacing with the SAM Series analog clock via the Converter Box, and the SRM Series analog clock and SBD 1000 digital clock via RS485. The master clock shall be powered by 110VAC/60 Hz or 220VAC/50 Hz. The master clock is pending FCC approval.

SMA 2000 upgrade options

Transmitter Option - The master clock shall be capable of transmitting data to the SAL wireless analog clock and the SBL wireless digital clock. The master clock shall be capable of acting as a repeater while receiving a signal wired or wirelessly from the main master clock. The master clock shall utilize 915–928 MHz frequency–hopping technology.

GPS – The master clock shall have the option of having a GPS receiver built into the unit for synchronization from the satellites via UTC. The antenna shall be roof mounted using the supplied 75 foot cable.

Web Interface – The master clock shall be able to be programmed completely from a web interface that can be accessed through any typical web browser such as Microsoft Internet Explorer or Mozilla FireFox. The interface shall allow the user to program all display features, IP settings of the master clock and any system setting that the master clock has.

SNTP Server – The master clock shall have the capability to act as a SNTP server that other devices can point to in order to receive the time through SNTP protocol.

3. The clock shall be a Sapling SBD 2000 digital clock and will have either a full 2.5" or 4.0" high-efficiency red or blue LED numeral display. The clock shall operate as a master clock to the SBD 1000 or SBD 2000, the SAM Series via two (2) wire digital communication, or SRM RS485 clocks. The clock shall be capable of receiving inputs from other systems. The clock will have data LEDs to display the receiving or transmitting of data. It shall have a 12 or 24 hour display format. It shall have three (3) levels of adjustable brightness and will feature immediate correction for time changes. The digital clock shall be installed either flush, surface or double mount. The clock shall have messaging capabilities including "BELL" and "FirE". The clock will have chronograph capabilities via the Sapling Control Box, as well as the ability to alternate between the current time and date. When the input is lost, the colon on the display of the clock shall flash. The clock bezel shall be anti-glare red or blue with a smooth surface. No external screws will be visible on the bezel or clock housing. The clock is to have UL, cUL and FCC compliance.

B. Analog Clocks

1. The secondary clock shall be Sapling SRM Series clock with RS485 protocol implementation. The clock shall have automatic frequency detection for time base. The clock will have self-diagnostic capabilities, relaying to the user information such as when the clock last received communication signals, and a comprehensive analysis of the clock. The SRM will have the ability for remote diagnosis from the master clock location. It shall have a maximum correction time of five (5) minutes. It will be designed to be used in a RS485 system with Sapling SBD 2000 Series Master Clock or Sapling 2000 or 3000 Series Master Clock systems, the GPS, or the SSM Master Clock which can regulate it by Sapling RS485 communication protocol. Upon receipt of the RS485 signal, the clock shall immediately self-correct. The secondary clock is to have a microprocessor based movement. The clock shall have a low-profile, semi-flush smooth surface metal case. The crystal is to be made of shatterproof, side molded, polycarbonate material. Glass and visible molding marks are unacceptable. The clock shall have black hour and minute hands as well as a red second hand. The clock shall have UL, cUL and FCC compliance.

A. Digital Clocks

The clock shall be either Sapling SBD 1000.

1. The clock shall be a Sapling SBD 1000 Digital Clock and shall have either a full 2.5" or 4.0" high efficiency red or blue LED numeral display. The clock will operate as a RS485 digital slave clock or as a two (2) wire digital communication digital slave clock. The clock is to have data LEDs, viewable to the user, in order to display the receiving or transmitting of data. It shall have a 12 or 24 hour display format. The clock shall have two (2) levels of adjustable brightness and shall feature immediate correction for time changes. The clock shall be installed either flush, surface or double mount. The clock will have messaging capabilities including "BELL" and "FirE". When the input is lost, the colon on the display of the clock shall flash. The clock bezel shall be anti-glare red or blue with a smooth surface. No external screws shall be visible on the bezel or clock housing. The clock shall have UL, cUL and FCC compliance.

4.0 EXAMINATION

- A. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the RS485 communication systems.
- B. Do not proceed until unsatisfactory conditions have been corrected.

4.1 INSTALLATION

A. General:

1. Install system in accordance with applicable codes. Install equipment in accordance with manufacturer's written instructions.

- B. Wiring Methods:
 - 1. Conceal wiring except in unfinished spaces.
 - 2. All new wiring on this project must be properly rated for the application.
 - 3. Cable to the new devices shall be installed in a neat and workmanlike manner, following the standard procedures used in the electrical contracting trade.
 - 4. Exposed wiring will not be permitted under any circumstances on this project.
 - 5. Any wiring, which considered sloppy by the Engineer, shall be strictly unacceptable.
 - 6. Upon installation completion, a room-by-room test shall be conducted for every device in the system. A technician shall perform the test after school hours, and repairs shall be performed as needed at no cost to the Owner to any devices, which do not function correctly, including cable. A written room-by-room report following testing and repairs shall be prepared and submitted to the Engineer.

5.0 FIELD QUALITY CONTROL

- A. Contractor Field Service
 - 1. Provide services of a service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.
- B. Inspection
 - 1. Make observations to verify that units and controls are properly labeled.
- C. Testing
 - 1. Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at the Contractor's expense. Verify by the system test that the total system meets the specifications and complies with applicable standards.

5.1 COMMISSIONING

- A. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventative maintenance of the system. Operators Manuals and Users Guides shall be provided at the time of this training.
- B. Schedule training with the Owner through the Architect, with at least seven (7) days advance notice.

5.2 CLEANING AND PROTECTION

- A. Prior to final acceptance, clean system components and protect from damage and deterioration.

Frequently Asked Questions

Which clock do I use for the RS485 system?

There are multiple choices to choose from. If analog clocks are required, we offer the SRM series analog clock, the SAZ series zone clock, and the SAH series large clock. For digital clocks, we offer the SBD 1000 series slave clock, the SBD 2000 digital master clock and the SBZ series zone clock. All of the aforementioned clocks are capable of receiving the RS485 signal.

Which master clock should I use?

The master clock needed is dependant on what the customer's needs are. The RS485 is outputted on every Sapling Master Clock. These clocks include: SMC 2000 and 3000 series Master Clock, the SBD 2000 series digital Master Clock, the SSM series Master Clock, the GPS Receiver, and the STR 2000 series Wireless Transceiver.

Can I still use the SAR series interchangeably with the newer model RS485 clocks?

Yes, the SAR is fully compatible with all of our newer model RS485 clocks.

How many wires is the RS485 communication?

The RS485 is a four (4) wire system. Two wires are used for providing power to the clocks, and two wires are used for the communication of the clock.

Do I have to use the same gauge wire on the power and communication line?

No. The communication line can use as low as 22 gauge wire.

Does the communication line have to be shielded and/or twisted?

The wire used for the communication line is decided by the user. It is not required to use UTP (unshielded twisted pair) or STP (shielded twisted pair). Call technical support for further information.

Can I parallel the communication line instead of daisy-chaining?

Yes, however there is a maximum of 32 clocks on a paralleled branch with a maximum distance of 3000 feet.

How many clocks can I have on the communication line if they are daisy-chained?

An unlimited amount of clocks can be ran off the same communication line as long as they are daisy-chained.

TROUBLESHOOTING

There is noise bleeding onto the intercom line. What do I do?

Change the data rate of the master clock. Please refer to the appropriate master clock manual for proper instructions.

The clock is not running, what do I do?

- a) Measure the voltage between the power (black) wire and the neutral (white) wire. The voltage should measure 85-135 volts in the 110 volt model or 7-28 volts in the 24 volt model.
- b) Make sure the transformer is an **isolated** transformer if using a 24 volt model.
- c) Make sure the ground wire is not touching other wires.

If you fail to follow the instructions in b and c listed above, the fuses can be blown.

The clock is not receiving communication signal from the Master Clock, what do I do?

Make sure the communication is in the correct polarity. If the polarity is flipped, the clock will **not** correct. If the polarity is correct, make sure that the clock before it is transmitting the signal.

How do I know if the clock is transmitting and receiving?

There are LEDs on the movement (analog clock) or the board (digital clock) which will flicker when the clock is receiving or transmitting data.