Trango Systems, Inc.

SDR900H™
900MHz Frequency Hopping Spread Spectrum Digital Wireless Transceiver System

Installation and Operating Instructions

03/21/2005
Revision C

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"Bench Test"

We strongly recommend that you set up your entire system on the bench before deployment. It will save you a lot of time and headaches, because it is much easier to troubleshoot configuration problems with everything (ie. camera, PTZ controller, and Trango radios) when they are right in front of you, and not up on the side of a building or mounted on a pole. You will also need to program the SDR900H radios with the SDRLink software, which can be downloaded from www.trangosys.com.

Note: The SDR900H is commonly used for wireless Pan/Tilt/Zoom control, but that is far from its only application. The SDR900H is a wireless serial data transmission system that can be used for any serial data application.

Quick-Start Guide

1) Prior to deploying your SDR900H, verify proper operation of your serial data devises (PTZ controller keyboard, and the hard-wired receiver/driver or dome).

2) Determine the baud rate and interface (RS232 or RS485/422) of the hard-wired system.

3) Set SW 3's switches to proper mode of operation (RS 232/422/485). Using SDRLink, program the proper baud rate, address, and channel into the radio. See page 8 for using the SDRLink software. Note: SW 4's switches should both be off.

SW 3
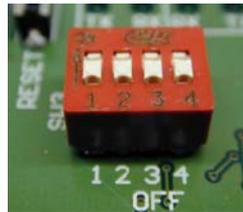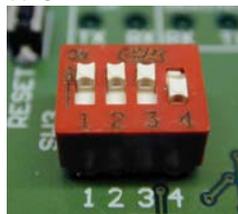
 Example: RS-232 Communication
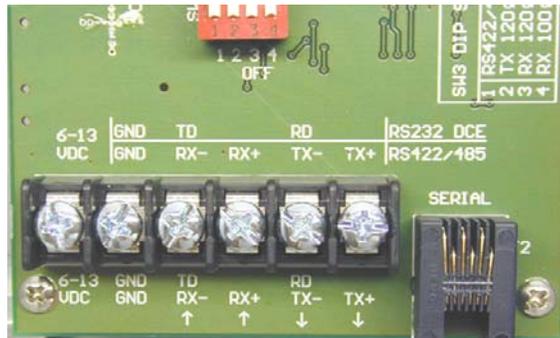
SW 3
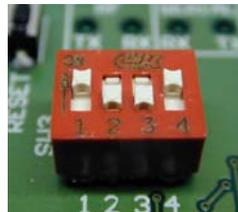
 Example: RS-422 Communication

SW 3

 Example: RS-485 Communication

Figure 1: SW 3 Settings for RS232, RS422, and RS485

4) Wire the terminal block with shielded twisted-pair cable.
For SDR900H at the controller connect the control to the RX+ and RX- terminals.
For SDR900H at camera side connect camera to the TX+ and TX- terminals.

Figure 2: Terminal Block

5) Attach antennas. (Note: Connector type – R-SMA)

6) After making the necessary adjustment to the internal settings and cables, "bench test" the wireless link at short range to verify operation before deployment.

7) Install the two SDR900H units in the desired locations to a 1 ½" - 2 3/8 " diameter steel pole.

8) Fasten the antenna cables to both units, and use no more than 8 lb/in. of torque. Tighten flange around cables. Apply a small amount of silicone to the flange openings to make a leak proof connection.

9) Connect shielded twisted-pair interface cables to units through the flanges. Tighten flanges. *Important! Power adapter must be kept dry.*

10) Verify that the RF TX LED is illuminated, and then tighten down the enclosure's lid.

11) To help protect against potential lightning damage use a lightning surge arrester in line with all cabling entering a structure.

Your Trango SDR900H System

Congratulations on choosing Trango Systems to fulfill your wireless video needs.

Unpack your system carefully. If any items are missing, notify your sales representative. If an item appears to be damaged from shipment, replace it into its packing material and notify the shipper. Note: Save the packing material for future storage of the equipment.

Service

If the unit ever needs repair service, contact your dealer/distributor for return authorization and shipping instructions. Do not attempt to repair the unit yourself, as this will void your warranty.

FCC Information

ID number for the SDR900H: FCC ID# OUR9XSTREAM
The enclosed device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

RF Exposure

Caution: This equipment is approved only for base station transmitting devices. Separation distances of (i) 20 centimeters or more for antennas with gains < 6 dBi, or (ii) 2 meters or more for antennas with gains ≥ 6 dBi, should be maintained between the antenna of this device and nearby persons during operation. To ensure compliance, operation at distances closer than these are not recommended.

The equipment generates, uses, and radiates radio-frequency energy. If not installed and used in accordance with these instructions, it may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment on or off, the user is encouraged to correct the interference by one of more of the following measures:

1) Reorient the receiving antenna
2) Separate the affected equipment from the receiver
3) Connect the affected equipment to an outlet on a different circuit from the one connected to the receiver
4) Consult the dealer and/or an experienced radio/TV technician for help

Important! Intentional or unintentional changes or modifications, not expressly approved by the party responsible for compliance, must not be made. Any modifications could void the user's authority to operate the equipment.

System Description

The SDR900H is a professional-quality wireless transmission system designed for sending digital signals, simplex (one-way), for example, pan/tilt/zoom camera control. The system employs 900MHz frequency-hopping spread-spectrum technology. The system will operate interference-free with Trango Falcon or Eagle series wireless video transmission systems to form a complete wireless solution for PTZ and video transmission. **Note: The SDR900H is a data transmission system, and is not limited to PTZ applications.**

Installation

Make sure that you have tested your serial data devises, such as PTZ controller and receiver/driver/dome, using a direct connection (with wires) before attempting to establish the wireless link. Also, it is recommended that the wireless link be "bench tested" at short range before deployment.

To obtain the best performance, and transmission distance, the following rules of thumb should be followed:

1) Mount the transceiver antennas above human and mechanical traffic, the higher the better. A ten-foot steel mast on top of a building is typical. Make sure that the mast is well grounded with a wire of 8 AWG or greater.
2) Keep the transmission path as open as possible. Objects such as walls and metallic objects near the transmission path may reduce the transmission distance.
3) Do not add additional lengths of cable to connect the transceiver to the antenna, as significant losses in signal and reduced transmission range will occur.
4) Keep the data link (shielded twisted-pair) cables as short as possible to prevent distortion of the data and possible interference from video running on coaxial cable nearby.

The SDR900H radios come pre-mounted in a NEMA 4X aluminum enclosure. This permits the unit to be mounted outdoors.

Important! The SDR900H enclosures are designed to be mounted on a steel pole with a maximum diameter of 2 3/8". The pole must be securely mounted into the ground, or to a structure to prevent movement of the antenna and camera in windy conditions. This pole also acts as an earth ground and *must be grounded*, or you will need to run an external ground wire from the radio to ground.

Point-to-Multipoint Operation

In some cases it may be necessary to control more than one camera from the same console. In this case, one SDR900H can be used to transmit a control signal, while a pair of SDR900H radios at the cameras will be used to receive the transmitted serial data signal. The user must ensure that all SDR900Hs used for receiving the signal have the same address and hopping sequence as the transmitting SDR900H. The above description is for simplex communication.

Note: For Bi-directional *half-duplex* communication, the SDR900Hs will act as transceivers.

Figure 3: Example of Point-to-Multipoint Configuration
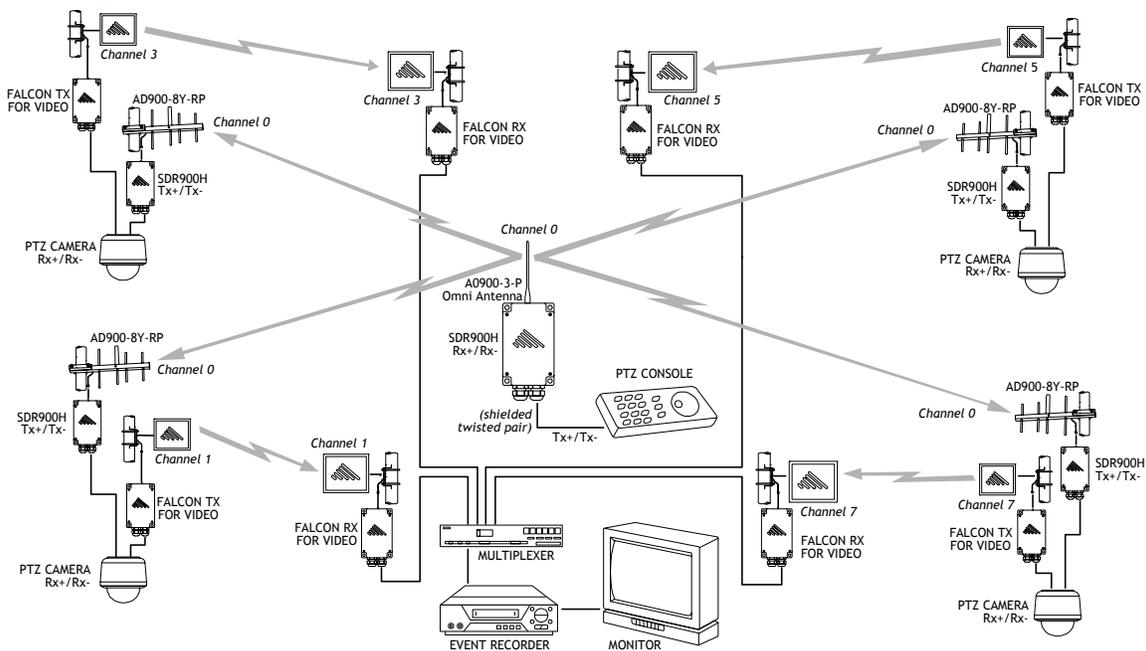
Multilink Operation

Different than point-to-multipoint operation, multilink is when more than one SDR900H is transmitting control signals. In this case, all the transceivers operating on one system would have the same hopping sequence and address. Those on another system nearby should have a different address and hopping sequence in order to isolate the systems.

Transceiver Operation

Antenna Jack: The connector is used to connect an appropriate Trango antenna. The antennas authorized for use with this unit are the whip (AO900-3-P) or the Yagi (AD900-8Y-RP). Fasten the connector with no more than 8 lb/in of torque. Any modification to the antenna jack may void the user's authority to operate the equipment, and will void the manufacturer's warranty.

Data Interfaces: There are two data interfaces: a terminal block, and a RJ11 connector. In order to avoid damage to the unit, do not use both the terminal block and the RJ11 connector for data output simultaneously.

1) Terminal Block – Two lugs serve as the input for simplex data from 1200 to 57600 bps. When transmitting under RS485/422 protocols, data wires from the PTZ controller will connect to the RX+ and RX- of the SDR900H terminal block. On the camera side connections are made to TX+ and TX- on the SDR900H terminal block. For RS232 the connections are to TD, RD, and GND.
2) RJ11 Connector (J2) – Attach the programming cable, CBLDAT-1, to this connector in order to use the SDRLink set-up program.

Power Input: Accepts a power source between 6 and 13 volts DC. It is highly recommended that the supplied power adapters (7VDC) be used to reduce the heat dissipated from the unit. If another power adapter is to be used, ensure that it is well regulated (+/-5%). Batteries may be used as an external power source as well. When the radio is transmitting the current draw is typically 250 mA, and 150 mA when receiving.

LEDs: There are four LEDs that provide quick status information for the unit.
RF TX – On when power is applied, blinks when data is transmitted out of RF interface.
RF RX – Blinks when data is received into the RF interface.
Serial RX – Blinks when data is received into the serial interface.
Serial TX – Blinks when data is transmitted out of the serial interface.

Switch 3: Used to configure mode of serial data to be transmitted. (RS232/422/485)
For RS232 operation positions 1-4 should be in the off (down) state.
For RS422 operation position 2 and 3 need to be off (down), and 1 and 4 on (up).
For RS485 operation position 4 should be off (down), and 1-3 on (up).

Switch 4: This switch is not used for PTZ control, and both position 1 and 2 should be in the off (down) state.

Config Button: Used to change the SDR900H mode from operation to configuration, so settings, such as address, baud rate, hopping sequence, etc, can be modified.

Reset Button: When in configuration mode if reset button is pushed all changes that have not been saved will be discarded and the previous values restored.

Transceiver Configuration Using SDRLink

1) Connect power to the radio. The white striped wire is positive 7 volts DC. It goes to the 6-13 VDC terminal on the radio, and the solid black wire goes to the GND terminal on the radio.

2) Set SW 3's switches for your particular data transmission mode.
   RS232 all switches in the down position.
   RS422 set positions 1 and 4 on (up), and positions 2 and 3 off (down). RS485 set positions 1-3 on (up), and Position 4 off (down).
   Note: SW 4 positions 1 and 2 should be off (down).

3) On the head end side connect the wires to the SDR900H's terminal block at Rx+ and Rx-.

4) On the camera side connect the wires to the SDR900H's terminal block at Tx+ and Tx-.

5) Connect to the SDR900H using the DB9 to RJ-11 cable connecting the DB9 to the serial port on your computer and the RJ-11 to the J2 on the radio.

6) Launch SDRLink on your the computer. (Download SDRLink programming software from www.trangosys.com, under "Downloads.")
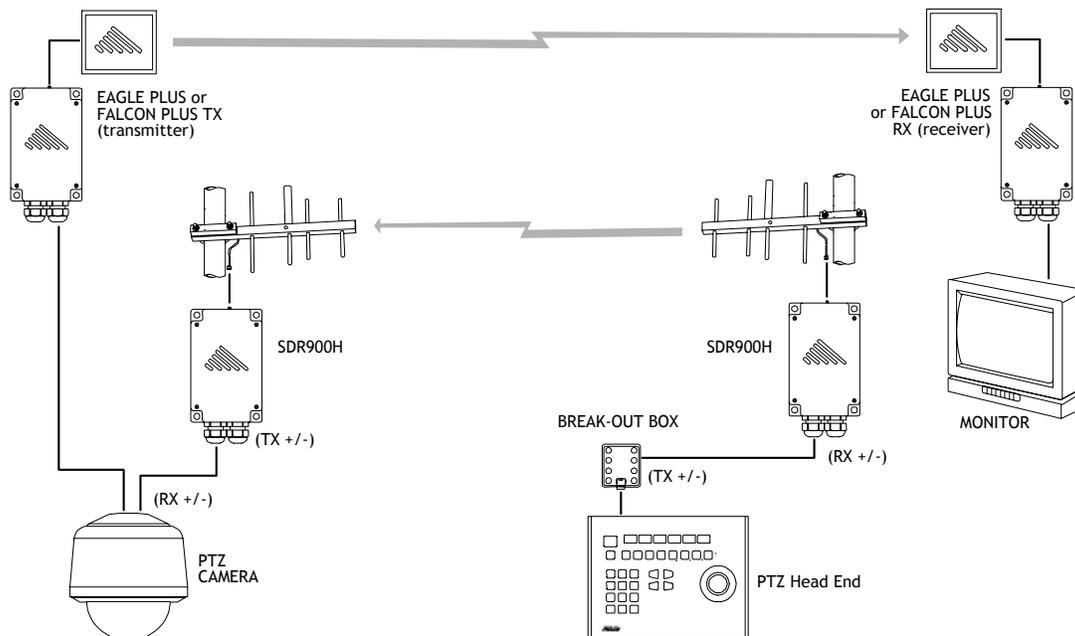
Figure 4: Example of Point-to-Point Configuration
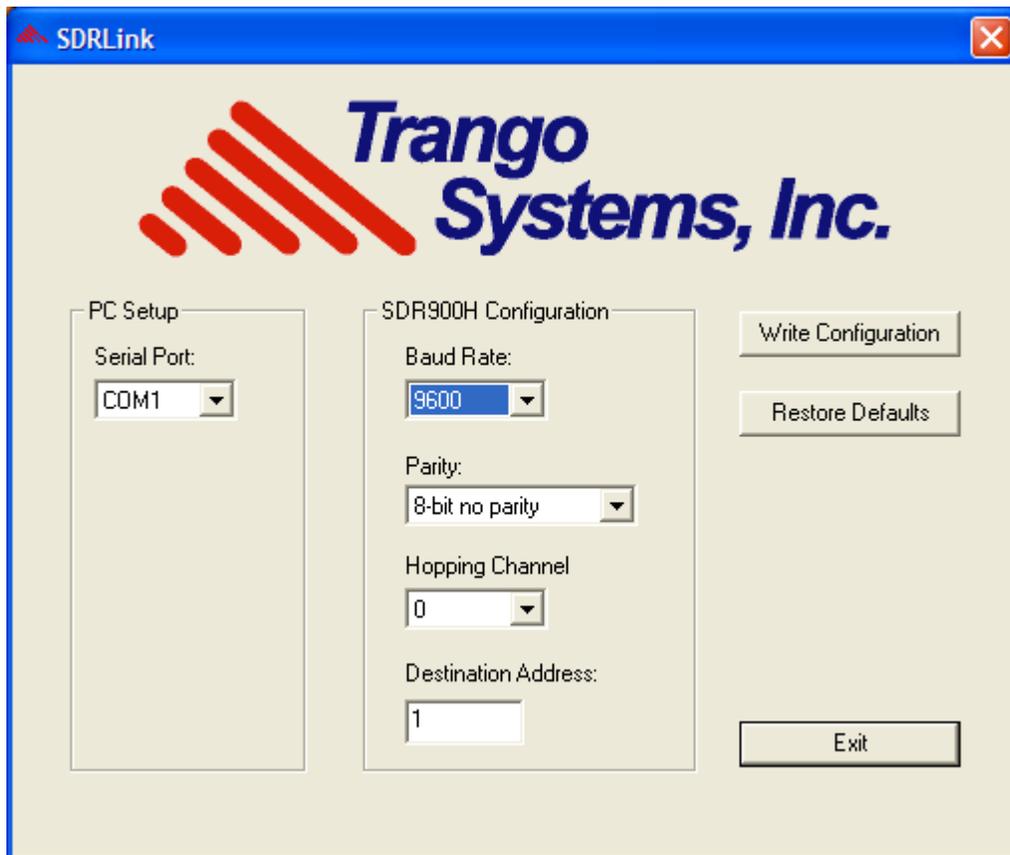
Example: SDR900H set to 9600 baud, 8 data bits, no parity, hopping channel 0, and address 1.

Figure 5: SDRLink Programming Software

7) Select the proper baud rate and parity to match the settings for your camera and controller.

8) Select the hopping channel and address to match the other SRD900H that will be communicating with the radio you are currently programming.

9) Click <u>Write Configuration</u> Tab.

10) Repeat steps 1 through 9 for any other SRD900H's that need to be configured.

11) Once all SDR900H's have been programmed verify operation of the wireless link.

Note: LEDs will not behave normally while CBLDAT-1 is attached to J2, and the terminal block is wired for RS422/485.

ARQ with the SDR900H
(Only for Point-to-Point Configurations)

To Turn on ARQ and Max. Bytes Sent in the SDR900H

1) To open HyperTerminal: in Windows XP go to Start, All Programs, Accessories, Communications, HyperTerminal
2) Once you have created the file name, proceed to open HyperTerminal, use the drop down window next to "connect using" to choose the proper com port and click OK.
3) HyperTerminal into the SDR900H (Ensure all switches are in the down position)
   > Hyper Terminal Settings:
   > Baud Rate: 19200
   > Data Bits: 8
   > Parity: none
   > Stop Bits: 1
   > Flow Control: none
4) In HyperTerminal screen go to File drop down and click on Properties, click on Settings, click on ASCII Setup, and chose "echo typed characters locally" and click OK
5) On radio Press config/reset, at same time, and release reset to enter command mode

NOTE: If the following commands are not issued within 15 seconds of each other the radio will exit command mode and step 5 will need to be repeated.

HyperTerminal screen should show "OK" if command mode was entered

6) Type ATRR 0x10 and hit Enter (Turns ARQ in with a 10 retry attempts)
   "OK" will be display if setting was accepted
7) Type ATTT 0x08 and hit Enter (Number of bytes to wait for before sending a packet)
   "OK" will be display if setting was accepted
   This setting is manufacturer dependent. Whatever the burst of data is equal to coming from the controller is what this setting needs to match.
8) Type ATWR and hit Enter (Saves changes to Flash memory)
   "OK" will be display if setting was accepted
9) Type ATCN and hit Enter (Exits command mode)
10) Reboot the SDR900H
11) Repeat steps 3-7 for any remaining SDR900H's.

Troubleshooting

Interference or intermittent operation

• Make sure all SDR900H radios are properly grounded.

• Heavy equipment, such as industrial roof-mounted air conditioners or fan motors, in close proximity to the radio or cables may cause interference, especially when operating in RS232 mode. Move the unit/cable away from the source of the interference.

• Raise the transmitter and receiver antennas above the ground and away from any obstacles and traffic, including foot traffic.

• Verify that all connectors are tight, especially the power connectors.

• Shorten the receiver antenna feed cable. It is best to use only those cables supplied with the equipment.

• If the system becomes unstable for a period of time on the order of minutes or hours and then becomes useable again, changing the channel may solve the problem

• High-power equipment operating near the 902-928MHz band, such as paging system base stations or cellular phone base stations, may also interfere if they are within several hundred feet of the radios. Changing the channel, and/or reorienting the antennas, will most likely solve this type of interference.

• The cable from the transceiver to the PTZ controller may be too long, corrupting the digital data. Use category 5 twisted-pair shielded cable for the cable run. The maximum length run for RS485/422 is four thousand feet, and one hundred feet for RS232.

• The cable from the transceiver to the camera may be too long, corrupting the digital data. Use category 5 twisted-pair shielded cable for the cable run. The maximum length run for RS485/422 is four thousand feet, and one hundred feet for RS232.

• Interference on video signal when sending PTZ data. Check the system's grounding, and use ground-fault isolation transformers if the problem persists.

Data not received

• Check that the transmit and receive channels, baud rate, mode, and address are set the same.

• Verify that all connectors are tight.

- Verify that data lines are connected correctly to terminal block.

- Cycle the power.

- Verify that the transmitter and receiver antennas are aligned properly. For distances greater than five hundred feet, check to see if clear line of site exists between units.

LEDs

- If the RF and Serial LEDs constantly flicker on and off in the radio connected to the controller when no data is being sent to the radio, run a ground wire between the radio and the controllers. If CBLDAT-1 is connected to J2, unplug CBLDAT-1.

- If RF and Serial LEDs constantly flicker on and off on the radio connected to the camera when no data is being sent to the radio, ensure that the RX+ and RX- coming from the camera is connected to TX+ and TX- on the terminal board in the radio. Verify if polarities match.

Can't communicate with the radios using SDRLink

- Disconnect any peripherals connected to the terminal block. Set both SW 3 and SW 4 to the off positions. Plug the supplied programming cable, CBLDAT-1, into J2 on the radio. Power the radio on, and connect to the radio using SDRLink.

- Open SDRLink and run Restore Defaults.

SDR900H Specifications

RF
- Half duplex
- 19200 bit/s real throughput
- 902 to 928 MHz ISM band
- 1 Watt maximum EIRP
- -104dBm RX sensitivity at 10-6 BER
- 25 hopping channels
- RSSI (measured during intended packet reception)
- FCC Part 15.247: OUR9XSTREAM
- DOC: 4214A-9XSTREAM

Serial
- Full duplex
- 1200 to 57600 bit/s software configurable
- Formats: 7/8 bits, Even/Odd/No Parity
- RS232 or RS485 DIP selectable
- RS232
  - DCE
  - 3 wire with included CBLDAT-1
  - configurable software flow control
  - optional 5 wire RTS/CST hardware handshaking flow control (requires CBLDAT-3, not included)
- RS485/422
  - optional multidrop
  - DIP switch enabled termination resistors: TX 120 Ohm, RX 120 or 100 Ohm

Configuration
- Downloadable GUI program, any serial port terminal, or terminal emulation software with AT commands

Power
- 6-13 V DC
- < 250 mA TX typically
- < 150 mA RX typically

Electrical Interfaces
- Modular 6-6 (RJ11) jack for RS232
- Barrier block with #6 screws for power, RS485/422, and RS232
- RP (male) SMA for antenna
- Ferrites on *all* data lines

Physical And Environmental
- NEMA rating: NEMA 4
- Dimensions: 12.0 x 22.4 x 6.4 cm (4.7 x 8.8 x 2.5 in)
- Weight: 1.25 Kg (2 lb. 12 oz.)
- Humidity: non-condensing
- Operating temperature: -40° to 70° C (-40° to 158° F)