IEC 60870 Points List and Implementation

Table of Contents

Section	Page
Introduction	2
Single-Point Information, Double-Point Information	3
Measured Value, Short Floating-Point Number	9
Single Command, Double Command	10
Protocol Implementation Conformance Statement	11
System or Device	11
Application Layer	11
Basic Application Function	20
Additional Notes on Product Configuration and Protocol Compliance	
Setpoint Mapping	27
Methods to Report Monitored Setpoint Data to the Controlling Station	27
Measured Value Scaling	28
Single, Double Commands	28

This instruction sheet defines IEC 60870-5-104 setpoints and protocol implementation information for the S&C TripSaver II Communications Gateway.

This instruction sheet is used with TripSaver II Communications Gateway software release 4.0. Other related software component version information is found on the *General Status* screen of the gateway Web-user interface.

The IEC 60870-5-104 controlling station can access the following **Single Point Information, Double Point Information, Measured Value, Single Command,** and **Double Command** points:

Point	Count
Single Point Information	129
Double Point Information	129
Measured Value (Short Floating-Point Number)	33
Single Command	13
Double Command	13

The available IEC 60870-5-104 points are listed in Tables 1 through 3 on page 3 through 10. The code values in the tables are also presented in the setpoint configuration tables on the TripSaver II Communications Gateway Web-user interface. Refer to S&C Instruction Sheet 461-519 for more details on the Web-user interface.

The gateway can connect to up to three TripSaver II reclosers. The setpoints associated with the TripSaver II reclosers can be mapped for one or more of the reclosers.

Table 1. Single-Point Information, Double-Point Information

Device	Code	Name—Definition
Gateway	1	**Communications gateway running on primary ac power—**On when ac power is being supplied to gateway; otherwise, off.
Gateway	2	**Communications gateway running on backup battery power—**On when gateway is being powered by backup battery; otherwise, off
Gateway	3	**Communications gateway is online—**On when gateway is online.
Gateway	4	**Communications gateway door is open—**On when external door is open; off when closed.
Gateway	5	**Communications gateway battery is present—**On when the gateway's optional battery is installed; off when battery is not present.
Gateway	6	**Communications gateway backup battery requires replacement—**On when battery has reached end of life; off when battery is operating normally.
Gateway	7	**Communications gateway established GPS synchronization—**On when gateway successfully synchronizes with GPS for time and location; off when gateway has yet to synchronize with GPS or loses sync.
Gateway	8	**Communications gateway remote Web-user interface access enabled—**On when the gateway's Web-user interface can be accessed via the gateway's WAN Ethernet interface (port #2). This requires two settings to be enabled. The first is set by the IEC controlling station via either single command or double command point code #1. The second is a local gateway setting that cannot be updated remotely. Off when either of those settings are disabled and, therefore, the gateway's Web-user interface cannot be accessed via the gateway's WAN Ethernet port.
Gateway	9	**Communications gateway remote Web-user interface access switch enabled via SCADA—On when either a single command point code #1 or a double command point code #1 has been enabled to allow remote access to the gateway's Web-user interface; off when these point codes are disabled.**
Gateway	10	**Communications gateway web user interface is being accessed—**On when a user is successfully logged in to gateway's Web-user interface; off when the user logs out.
Gateway	11	**Communications gateway Web-user interface authentication rejected—**On when the user attempts to log in to the gateway Web-user interface and does not pass authentication; off when the user logs in successfully or after 5 minutes to clear the event.
Gateway	12	**Communications gateway configuration changed via Web-user interface—**On when the user changes a configuration parameter directly via the gateway's Web-user interface; off after 5 minutes to clear the event.
Gateway	13	**Communications gateway configuration file imported—**On when the user imports a configuration file via the gateway's Web-user interface; off after 5 minutes to clear the event.
Gateway	14	**Communications gateway configuration file exported—**On when the user exports a configuration file via the gateway's Web-user interface; off after 5 minutes to clear the event.

TABLE CONTINUED ►

Table 1. Single-Point Information, Double-Point Information

Device	Code	Name—Definition
Gateway	15	**Communications gateway secure tunnel added—**On when the user adds a secure tunnel via the gateway's Web-user interface; off after 5 minutes to clear the event.
Gateway	16	**Communications gateway secure tunnel changed—**On when the user changes a secure tunnel via the gateway's Web-user interface; off after 5 minutes to clear the event.
Gateway	17	**Communications gateway secure tunnel removed—**On when the user removes a secure tunnel via the gateway's Web-user interface; off after 5 minutes to clear the event.
Gateway	18	**Communications gateway firmware upgrade success—**On when the Web-user interface user attempts and successfully installs a firmware upgrade; off after 5 minutes to clear the event.
Gateway	19	**Communications gateway firmware upgrade rejected—**On when the Web-user interface user attempts to install a firmware upgrade but the gateway rejects it as an invalid firmware image; off when the gateway accepts a valid firmware image or after 5 minutes to clear the event.
Gateway	20	**Communications gateway user account added—**On when the administrative user adds a new user account via the gateway's Web-user interface; off after 5 minutes to clear the event.
Gateway	21	**Communications gateway user account removed—**On when the administrative user removes a user account via the gateway's Web-user interface; off after 5 minutes to clear the event.
Gateway	22	**Communications gateway user account password changed—**On when the administrative user changes the password for a user account via the gateway's Web-user interface; off after 5 minutes to clear the event.
Gateway	23	**Communications gateway TripSaver II recloser added—**On when a new TripSaver II recloser is added via the gateway's Web-user interface; off after 5 minutes to clear the event.
Gateway	24	**Communications gateway TripSaver II recloser removed—**On when a TripSaver II recloser is removed via the gateway's Web-user interface; off after 5 minutes to clear the event.
Gateway	25	**Communications gateway diagnostic log retrieved—**On when diagnostic logs are retrieved via the gateway's Web-user interface; off after 5 minutes to clear the event.
Gateway	26	**Communications gateway reboot initiated via Web-user interface—**On when the Web user triggers a reboot of the gateway. The point will go offline as the gateway reboots and will go to the **Off** setting after the reboot completes.
Gateway	27	**Communications gateway gang operation initiated via Web-user interface—**On when the Web user initiates a gang operation; off after 5 minutes to clear the event.

TABLE CONTINUED ►

Table 1. Single-Point Information, Double-Point Information

Device	Code	Name—Definition
Gateway	28	**Communications gateway gang operation cancelled via Web-user interface—**On when the Web user cancels a gang operation; off after 5 minutes to clear the event.
Gateway	29	**Communications gateway Remote Gang Drop Open operation in progress—**On when the operation is in progress; off after all reclosers in the gang have dropped open, when retries have been exhausted, or when the Web user cancels the drop-open retries by either clicking on the **Cancel** button or placing the dropped open recloser back into the cutout mounting.
Gateway	30	**Communications test—**Reflects the state from the **Communications Test** command (single command, double command code #4). The initial state on power up is off. Each time the **Communications test** command is received, this value is toggled.
TripSaver II recloser	1001-TS#1 2001-TS#2 3001-TS#3	**TripSaver II recloser connection to the gateway has been lost—**On when the connection to the gateway has been lost for at least 5 minutes; off when TripSaver II recloser connection is re-established.
TripSaver II recloser	1002, 2002, 3002	**TripSaver II recloser connected to the service center configuration (SCC) software via the gateway—**On when the SCC software tool is being used to manage the TripSaver II recloser via the gateway; off when the SCC software session completes.
TripSaver II recloser	1003, 2003, 3003	**TripSaver II recloser vacuum interrupter is open—**On when the TripSaver II recloser has opened its vacuum interrupter; otherwise, off.
TripSaver II recloser	1004, 2004, 3004	**TripSaver II recloser vacuum interrupter is closed—**On when the TripSaver II recloser's vacuum interrupter is closed; otherwise, off.
TripSaver II recloser	1005, 2005, 3005	**TripSaver II recloser dropped open due to fault current event—**On when the TripSaver II recloser has physically dropped open in response to a fault; off when the TripSaver II recloser is online (single-point or double-point code x017).
TripSaver II recloser	1006, 2006, 3006	**TripSaver II recloser dropped open because of a sectionalizing event—**On when the TripSaver II recloser has physically dropped open because of a sectionalizing event; off when the TripSaver II recloser is online (single-point or double-point code x017).
TripSaver II recloser	1007, 2007, 3007	**TripSaver II recloser dropped open because of an overload event—**On when the TripSaver II recloser has physically dropped open because of an overload event; off when the TripSaver II recloser is online (single-point or double-point code x017).
TripSaver II recloser	1008, 2008, 3008	**TripSaver II recloser had an overcurrent trip event—**On when the TripSaver II recloser detects an overcurrent trip event; off when the TripSaver II recloser clears a temporary fault or when the TripSaver II recloser is brought back online (single-point or double-point code x017) following a drop open.
TripSaver II recloser	1009, 2009, 3009	**TripSaver II recloser needs to be serviced now—**On when the TripSaver II recloser has entered the **Service Now** state and requires immediate attention.
TripSaver II recloser	1010, 2010, 3010	**TripSaver II recloser needs to be serviced soon—**On when the TripSaver II recloser's vacuum interrupter has 10% of its remaining contact wear.

TABLE CONTINUED ►

Table 1. Single-Point Information, Double-Point Information

Device	Code	Name—Definition
TripSaver II recloser	1011, 2011, 3011	**TripSaver II recloser currently in Auto mode—**On when the TripSaver II recloser is in **Auto (Reclosing)** mode; off when the TripSaver II recloser is in the **NR** (non-reclosing) mode. (This point code is derived from single-point or double-point codes x012, x013, and x014.)
TripSaver II recloser	1012, 2012, 3012	**TripSaver II recloser lever in the AUTO position—**On when the MODE-SELECTOR lever is in the **Auto** (up) position. Off when the MODE-SELECTOR lever is in the **NR** (down) position.
TripSaver II recloser	1013, 2013, 3013	**TripSaver II recloser Remote-NR mode enabled—**On when the TripSaver II recloser's **Remote NR** setting is enabled; off when disabled.
TripSaver II recloser	1014, 2014, 3014	**TripSaver II recloser is temporarily in Auto mode after a manual reclose—**On when the TripSaver II recloser is temporarily running in **Auto** mode after a manual reclose before returning to **Remote NR** mode; off when the TripSaver II recloser transitions back to **Remote NR** mode after 5 minutes. (For more details on this temporary mode, please refer to S&C Instruction Sheet 461-502.)
TripSaver II recloser	1015, 2015, 3015	**TripSaver II recloser attempted to drop open but did not—**On when the TripSaver II recloser attempted to drop open but didn't. (e.g. cutout icing situation or path blocked by foreign object.) Off when the TripSaver II recloser is online (single-point or double-point code x017).
TripSaver II recloser	1016, 2016, 3016	**TripSaver II recloser swung to horizontal position with the vacuum interrupter closed—**On when the TripSaver II recloser unexpectedly shifted to a horizontal position while the vacuum interrupter remained closed; off when TripSaver II recloser restored to proper orientation.
TripSaver II recloser	1017, 2017, 3017	**TripSaver II recloser is online—**On when TripSaver II recloser is powered up and communicating with the communication gateway; otherwise, off.
TripSaver II recloser	1018, 2018, 3018	**TripSaver II recloser powering down because of a lack of load current—**On when the TripSaver II recloser is in the process of powering down because of a lack of available load current; off when the TripSaver II recloser is online (single-point or double-point code x017).
TripSaver II recloser	1019, 2019, 3019	**TripSaver II recloser battery is out of service—**On when recloser battery is out of service; off when recloser battery is operating normally.
TripSaver II recloser	1020, 2020, 3020	**TripSaver II recloser user triggered a successful Local Manual Open operation—**On when a local user triggers the **Local Manual Open** (LMO) feature to force the TripSaver II recloser to drop open; off when the TripSaver II recloser is online (single-point or double-point code x017).

TABLE CONTINUED ►

Table 1. Single-Point Information, Double-Point Information

Device	Code	Name—Definition
TripSaver II recloser	1021, 2021, 3021	**TripSaver II recloser detected a suspicious attempt to trigger a Local Manual Open operation—**On when a local user attempts to trigger the **Local Manual Open** (LMO) feature but the feature is not enabled; off after 5 minutes to clear the event.
TripSaver II recloser	1022, 2022, 3022	**TripSaver II recloser gateway Local Drop Open control enabled—**On when the TripSaver II recloser's gateway local drop-open capability is enabled; off when disabled.
TripSaver II recloser	1023, 2023, 3023	**TripSaver II recloser dropped open because of a Drop Open command—**On when the TripSaver II recloser has physically dropped open because of an accepted gateway requested **Drop Open** command; off when the TripSaver II recloser is online (single-point or double-point code x017).
TripSaver II recloser	1024, 2024, 3024	**TripSaver II recloser rejected a Drop Open command because of insufficient energy—**On when the TripSaver II recloser rejected a request from the gateway to perform a Drop Open function because of insufficient stored energy to execute the Drop Open sequence; off when TripSaver II recloser successfully drops open (single-point or double-point code x023) or a **Gang Operation** sequence completes.
TripSaver II recloser	1025, 2025, 3025	**TripSaver II recloser rejected a Drop Open command because of excessive line current—**On when the TripSaver II recloser rejected a request from the gateway to perform a **Drop Open** function because of a current level that exceeds the TripSaver II recloser's rated interruption capability; off when TripSaver II recloser successfully drops open (single-point or double-point code x023) or a **Gang Operation** sequence completes.
TripSaver II recloser	1026, 2026, 3026	**TripSaver II recloser rejected a Drop Open command because of configuration—**On when the TripSaver II recloser rejected a request from the gateway to perform a **Drop Open** function because the gateway **Drop Open Control Enable** setting is disabled (single-point or double-point code x022); off when a **Gang Operation** sequence completes.
TripSaver II recloser	1027, 2027, 3027	**Reserved.**
TripSaver II recloser	1028, 2028, 3028	**TripSaver II recloser attempted to drop open because of a Drop Open command but did not—**On when the TripSaver II recloser attempted to drop open because of a **Drop Open** command from the gateway but didn't (e.g. cutout icing situation or path blocked by foreign object). This is an error condition; off when the TripSaver II recloser is online (single-point or double-point code x017).
TripSaver II recloser	1029, 2029, 3029	**TripSaver II recloser dropped open because of a fault-current event while operating with standard NR TCC curve—**On when the TripSaver II recloser has physically dropped open in response to a fault while operating with the standard NR TCC curve; off when the TripSaver II recloser is online (single-point or double-point code x017).
TripSaver II recloser	1030, 2030, 3030	**TripSaver II recloser dropped open because of a fault-current event while operating with cold wakeup NR TCC curve—**On when the TripSaver II recloser has physically dropped open in response to a fault while operating with the cold wakeup NR TCC curve; off when the TripSaver II recloser is online (single-point or double-point code x017).

TABLE CONTINUED ►

Table 1. Single-Point Information, Double-Point Information

Device	Code	Name—Definition
TripSaver II recloser	1031, 2031, 3031	**TripSaver II recloser dropped open because of a fault-current event while operating with post-fault wakeup NR TCC curve—**On when the TripSaver II recloser has physically dropped open in response to a fault while operating with the post-fault wakeup NR TCC curve; off when the TripSaver II recloser is online (single-point or double-point code x017).
TripSaver II recloser	1032, 2032, 3032	**TripSaver II recloser single unit Remote Drop Open operation in progress—**On when the procedure is in progress; off after the TripSaver II recloser has dropped open, when retries have been exhausted, or when the Web-user cancels the gang operation retries by either clicking on the **Cancel** button or placing the dropped open recloser back into the cutout mounting.
TripSaver II recloser	1033, 2033, 3033	**TripSaver II recloser sequence coordination protection is active—**On when the TripSaver II recloser has entered the **Sequence Coordination** state; off after the TripSaver II recloser has exited the **Sequence Coordination** state and has returned to an existing protection curve.
TripSaver II recloser	1034, 2034, 3034	**TripSaver II recloser in horizontal position—**On when the TripSaver II recloser is in the horizontal position (dropped open), for any reason; off when the TripSaver II recloser is in the vertical position (closed in).

Table 2. Measured Value, Short Floating-Point Number

Device	Code	Name—Definition
Gateway	1	**Communication gateway battery voltage—**Nominally 12 Vdc; one count equals 0.01 Vdc.
Gateway	2	**Communication Gateway GPS Latitude—**Provides the communication gateway's GPS latitude reading in decimal degrees format.
Gateway	3	**Communication Gateway GPS Longitude—**Provides the communication gateway's GPS longitude reading in decimal degrees format.
TripSaver II recloser	1001-TS#1 2001-TS#2 3001-TS#3	**Communication gateway 802.15.4 received signal strength from TripSaver II recloser—**The received signal strength for transmissions from a specific TripSaver II recloser on the gateway's 802.15.4 network interface; signed value with unit 1 dBm, for example -63 dBm. **Note**: -63 dBm is better than -90 dBm.
TripSaver II recloser	1002, 2002, 3002	**TripSaver II recloser real time load current—**Single-phase load current; each count equals one ampere.
TripSaver II recloser	1003, 2003, 3003	**TripSaver II recloser fault current magnitude—**Current at time of trip for the last overcurrent event detected; each count equals 1 ampere.
TripSaver II recloser	1004, 2004, 3004	**TripSaver II recloser battery voltage—**Nominally 3.9 Vdc; one count equals 0.01 Vdc.
TripSaver II recloser	1005, 2005, 3005	**TripSaver II recloser 802.15.4 received signal strength—**The received signal strength on the TripSaver II recloser's 802.15.4 network interface; signed value with unit 1 dBm, for example -63 dBm.
TripSaver II recloser	1006, 2006, 3006	**TripSaver II recloser number of times vacuum interrupter opened—**The number of times the TripSaver II recloser's vacuum interrupter opened.
TripSaver II recloser	1007, 2007, 3007	**TripSaver II recloser number of times dropped open—**The number of times the TripSaver II recloser dropped open.
TripSaver II recloser	1008, 2008, 3008	**TripSaver II recloser number of times dropped open because of a gateway command—**The number of times the TripSaver II recloser successfully dropped open because of a gateway **Drop Open** command.
TripSaver II recloser	1009, 2009, 3009	**TripSaver II recloser number of times gateway Drop Open command was rejected because of the configuration—**The number of times the TripSaver II recloser rejected a gateway **Drop Open** command because of the configuration. (Can be triggered by either a Local Drop Open event or a Remote Drop Open event.)
TripSaver II recloser	1010, 2010, 3010	**TripSaver II recloser number of times gateway Drop Open command was unsuccessful for other reasons—**The number of times a gateway **Drop Open** command to the TripSaver II recloser was unsuccessful for other reasons (e.g. attempted to drop open but failed, insufficient energy, or excessive line current).This could be incremented multiple times during a single **Drop Open** procedure caused by retries from the gateway.

Table 3. Single Command, Double Command

Device	Code	Name—Definition
Gateway	1	**Communications gateway remote Web-user interface switch—**This controls the accessibility of the gateway's Web-user interface. A command setting the state to **On** enables remote access via Ethernet port #2 and sets single-point or double-point code 9 active. A command setting the state to **Off** disables remote access via Ethernet port #2 and sets single point or double point code 9 inactive.
Gateway	2	**Communications gateway remote Gang Drop Open command—**This triggers the remote initiation of a **Gang Drop Open** process. Initiation is triggered by a command setting the state to **On** and is the equivalent of a momentary close.
Gateway	3	**Remote NR mode ALL switch—**This controls the **Auto** mode of all TripSaver II reclosers provisioned in the gateway with a single transaction. Each TripSaver II recloser is updated independently. A command setting the state to **On** disables **Auto** mode and sets single-point or double-point code x013 as active. A command setting the state to **Off** enables the **Auto** mode and sets single point or double point code x013 as inactive. If there is a timing conflict between this point and single-command or double-command code x001, the most recently received command will have precedence.
Gateway	4	**Communication Test—**Toggles the state of the Communication Test setpoint (single-point, double-point code #30) each time this command is received. Initiation is triggered by a command setting the state to either the **On** or **Off** state and is the equivalent of a momentary close.
TripSaver II recloser	1001-TS#1 2001-TS#2 3001-TS#3	**Remote NR mode switch —**This controls the **Auto** mode of the TripSaver II recloser. A command setting the state to **On** disables **Auto** mode and sets single point or double point code x013 as active. A command setting the state to **Off** enables the **Auto** mode and sets the single point or double point code x013 as inactive. If there is a timing conflict between this point and single-command or double-command code 3, the most recently received command will have precedence.
TripSaver II recloser	1002, 2002, 3002	**Gateway Local Drop Open Control enable—**This controls the gateway local drop-open capability of the TripSaver II recloser. A command setting the state to **On** enables the gateway drop-open capability and sets single-point or double-point code x022 active. A command setting the state to **Off** disables the gateway drop-open capability and sets single-point or double-point code x022 inactive.
TripSaver II recloser	1003, 2003, 3003	**Communications gateway remote single-unit Drop Open command—**This triggers the remote initiation of a single-unit **Drop Open** procedure. Initiation is triggered by a command setting the state to **On** and is the equivalent of a momentary close.

System or device

☐ System definition
☐ Controlling station definition (master)
☒ Controlled station definition (slave)

Application layer

Transmission mode for application data

Mode 1 (least significant octet first), as defined in 4.10 of IEC 60870-5-4, is used exclusively in this companion standard.

Common address of ASDU

(System-specific parameter, all configurations that are used are to be marked "X")

■ ~~One~~ ☒ Two

Information object address

(System-specific parameter, all configurations that are used are to be marked "X")

■ ~~One~~ ☐ Structured
■ ~~Two octets~~ ☒ Unstructured
☒ Three

Cause of transmission

(System-specific parameter, all configurations that are used are to be marked "X")

■ ~~One~~ ☒ Two octets (with originator address.)
Originator address is set to zero if not used.

Length of APDU

The maximum length of ADPU for both directions is 253. It is a fixed system parameter.

Selection of Standard ASDUs

Process information in monitor direction

[X] <1> := Single-point information	M_SP_NA_1
[X] <3> := Double-point information	M_DP_NA_1
[ ] <5> := Step-position information	M_ST_NA_1
[ ] <7> := Bitstring of 32 bit	M_BO_NA_1
[ ] <9> := Measured value, normalized value	M_ME_NA_1
[ ] <11> := Measured value, scaled value	M_ME_NB_1
[X] <13> := Measured value, short floating point number	M_ME_NC_1
[ ] <15> := Integrated totals	M_IT_NA_1
[ ] <20> := Packed single-point information with status change detection	M_PS_NA_1
[ ] <21> := Measured value, normalized value without quality descriptor	M_ME_ND_1
[X] <30> := Single-point information with time tag CP56Time2a	M_SP_TB_1
[X] <31> := Double-point information with time tag CP56Time2a	M_DP_TB_1
[ ] <32> := Step position information with time tag CP56Time2a	M_ST_TB_1
[ ] <33> := Bitstring of 32 bit with time tag CP56Time2a	M_BO_TB_1
[ ] <34> := Measured value, normalized value with time tag CP56Time2a	M_ME_TD_1
[ ] <35> := Measured value, scaled value with time tag CP56Time2a	M_ME_TE_1
[X] <36> := Measured value, short floating point number with time tag CP56Time2a	M_ME_TF_1
[ ] <37> := Integrated totals with time tag CP56Time2a	M_IT_TB_1
[ ] <38> := Event of protection equipment with time tag CP56Time2a	M_EP_TD_1
[ ] <39> := Packed start events of protection equipment with time tag CP56Time2a	M_EP_TE_1
[ ] <40> := Packed output circuit information of protection equipment with time tag CP56Time2a	M_EP_TF_1

TABLE CONTINUED ►

Process information in control direction

[X] <45> := Single command	C_SC_NA_1
[X] <46> := Double command	C_DC_NA_1
[ ] <47> := Regulating step command	C_RC_NA_1
[ ] <48> := Setpoint command, normalized value	C_SE_NA_1
[ ] <49> := Setpoint command, scaled value	C_SE_NB_1
[ ] <50> := Setpoint command, short floating point value	C_SE_NC_1
[ ] <51> := Bitstring of 32 bit	C_BO_NA_1
[X] <58> := Single command with time tag CP56Time2a	C_SC_NA_1
[X] <59> := Double command with time tag CP56Time2a	C_DC_NA_1
[ ] <60> := Regulating step command with time tag CP56Time2a	C_RC_NA_1
[ ] <61> := Setpoint command, normalized value with time tag CP56Time2a	C_SE_NA_1
[ ] <62> := Setpoint command, scaled value with time tag CP56Time2a	C_SE_NB_1
[ ] <63> := Setpoint command, short floating point value with time tag CP56Time2a	C_SE_NC_1
[ ] <64> := Bitstring of 32 bit with time tag CP56Time2a	C_BO_NA_1

TABLE CONTINUED ►

System information in monitor direction

(Station-specific parameter, mark each with an "X" if it is only used in the standard direction, "R" if only used in the reverse direction, and "B" if used in both directions).

[X] <70> := End of initialization	M_EI_NA_1

System information in control direction

(Station-specific parameter, mark each Type ID "X" if it is only used in the standard direction, "R" if only used in the reverse direction, and "B" if used in both directions).

[X] <100> := Interrogation command	C_IC_NA_1
[X] <101> := Counter interrogation command	C_CI_NA_1
[X] <102> := Read command	C_RD_NA_1
[X] <103> := Clock synchronization command	C_CS_NA_1
[X] <105> := Reset process command	C_RP_NA_1
[X] <107> := Test command with time tag CP56Time2a	C_TS_TA_1

Parameter in control direction

(Station-specific parameter, mark each Type ID "X" if it is only used in the standard direction, "R" if only used in the reverse direction, and "B" if used in both directions).

[ ] <110> := Parameter of measured value, normalized value	P_ME_NA_1
[ ] <111> := Parameter of measured value, scaled value	P_ME_NB_1
[ ] <112> := Parameter of measured value, short floating point value	P_ME_NC_1
[ ] <113> := Parameter activation	P_AC_NA_1

File transfer

(Station-specific parameter, mark each Type ID "X" if it is only used in the standard direction, "R" if only used in the reverse direction, and "B" if used in both directions).

☐ <120> := File ready	F_FR_NA_1
☐ <121> := Section ready	F_SR_NA_1
☐ <122> := Call directory, select file, call file, call section	F_SC_NA_1
☐ <123> := Last section, last segment	F_LS_NA_1
☐ <124> := Ack file, ack section	F_AF_NA_1
☐ <125> := Segment	F_SG_NA_1
☐ <126> := Directory	F_DR_TA_1
☐ <127> := Query Log–Request archive file	F_SC_NB_1

Type identifier and cause of transmission assignments (Station-specific parameters)

Cause of Transmission Numbers

Number	Cause of Transmission
1	Periodic, cyclic
2	Background scan
3	Spontaneous
4	Initialized
5	Request or requested
6	Activation
7	Activation confirmation
8	Deactivation
9	Deactivation confirmation
10	Activation termination
11	Return information caused by a remote command
12	Return information caused by a local command
13	File transfer
20	Interrogated by station interrogation
21 to 36	Interrogated by group <number> interrogation
37	Requested by general counter request
38 to 41	Requested by group <number> counter request
44	Unknown type of identification
45	Unknown cause of transmission
46	Unknown command address of ASDU
47	Unknown information object address

TABLE CONTINUED ►

Shaded boxes are not defined in this companion standard and shall not be used.
Black boxes: Option not permitted in this companion standard
Blank: Functions or ASDU not used.

Mark Type Identification/Cause of transmission combinations:
"X" if only used in the standard direction
"R" if only used in the reverse direction
"B" if used in both directions

Type Identification		Cause of Transmission																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	20 to 36	37 to 41	44	45	46	47
<1>	M_SP_NA_1		X			X									X					
<3>	M_DP_NA_1		X			X									X					
<5>	M_ST_NA_1																			
<7>	M_BO_NA_1																			
<9>	M_ME_NA_1																			
<11>	M_ME_NB_1																			
<13>	M_ME_NC_1	X				X									X					
<15>	M_IT_NA_1																			
<20>	M_PS_NA_1																			
<21>	M_ME_ND_1																			
<30>	M_SP_TB_1			X																
<31>	M_DP_TB_1			X																
<32>	M_ST_TB_1																			

TABLE CONTINUED ►

Type Identification		Cause of Transmission																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	20 to 36	37 to 41	44	45	46	47
<33>	M_BO_TB_1																			
<34>	M_ME_TD_1																			
<35>	M_ME_TE_1																			
<36>	M_ME_TF_1			X																
<37>	M_IT_TB_1																			
<38>	M_EP_TD_1																			
<39>	M_EP_TE_1																			
<40>	M_EP_TF_1																			
<45>	C_SC_NA_1						X	X										X	X	X
<46>	C_DC_NA_1						X	X										X	X	X
<47>	C_RC_NA_1															X				
<48>	C_SE_NA_1															X				
<49>	C_SE_NB_1															X				
<50>	C_SE_NC_1															X				
<51>	C_BO_NA_1															X				
<58>	C_SC_TA_1						X	X										X	X	X
<59>	C_DC_TA_1						X	X										X	X	X
<60>	C_RC_TA_1															X				
<61>	C_SE_TA_1															X				
<62>	C_SE_TB_1															X				

TABLE CONTINUED ►

Type Identification		Cause of Transmission																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	20 to 36	37 to 41	44	45	46	47
<63>	C_SE_TC_1																X			
<64>	C_BO_TA_1																X			
<70>	M_EI_NA_1*			X																
<100>	C_IC_NA_1						X	X										X	X	
<101>	C_CI_NA_1						X	X										X	X	
<102>	C_RD_NA_1					X												X	X	X
<103>	C_CS_NA_1						X	X										X	X	
<105>	C_RP_NA_1						X	X										X	X	
<107>	C_TS_TA_1						X	X										X	X	
<110>	P_ME_NA_1																X			
<111>	P_ME_NB_1																X			
<112>	P_ME_NC_1																X			
<113>	P_AC_NA_1																X			
<120>	F_FR_NA_1																X			
<121>	F_SR_NA_1																X			
<122>	F_SC_NA_1																X			
<123>	F_LS_NA_1																X			
<124>	F_AF_NA_1																X			
<125>	F_SG_NA_1																X			
<126>	F_DR_TA_1*																			
<127>	F_SC_NB_1*																X			

Note: Mark cause of transmission (COT) 44 only for unsupported type identifications.

Basic application functions

Station initialization

(Station-specific parameter, mark "X" if function is used)

[X] Remote initialization

Cyclic data transmission

(Station-specific parameter, mark "X" if function is only used in the standard direction, "R" if only used in the reverse direction, and "B" if used in both directions)

[X] Cyclic data transmission

Read procedure

(Station-specific parameter, mark "X" if function is only used in the standard direction, "R" if only used in the reverse direction, and "B" if used in both directions)

[X] Read procedure

Spontaneous transmission

(Station-specific parameter, mark "**X**" if function is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions)

[X] Spontaneous transmission

Double transmission of information objects with cause of transmission spontaneous

(Station-specific parameter, mark each information type "X" where both a Type ID without time and corresponding Type ID with time are issued in response to a single spontaneous change of a monitored object)

The following type identifications may be transmitted in succession caused by a single status change of an information object. The particular information object addresses for which double transmission is enabled are defined in a project-specific list:

- ☐ Single-point information M_SP_NA_1, M_SP_TA_1, M_SP_TB_1 and M_PS_NA_1
- ☐ Step-position information M_ST_NA_1, M_ST_TA_1 and M_ST_TB_1
- ☐ Double-point information M_DP_NA_1, M_DP_TA_1 and M_DP_TB_1
- ☐ Bitstring of 32 bit M_BO_NA_1, M_BO_TA_1 and M_BO_TB_1 (if defined for a specific project)
- ☐ Measured value, normalized value M_ME_NA_1, M_ME_TA_1, M_ME_ND_1 and M_ME_TD_1
- ☐ Measured value, scaled value M_ME_NB_1, M_ME_TB_1 and M_ME_TE_1
- ☐ Measured value, short floating-point number M_ME_NC_1, M_ME_TC_1 and M_ME_TF_1

Station interrogation

(Station-specific parameter, mark "**X**" if function is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions).

- ☒ global
- ☒ group 1
- ☒ group 2
- ☒ group 3
- ☒ group 4
- ☒ group 5
- ☒ group 6
- ☒ group 7
- ☒ group 8
- ☒ group 9
- ☒ group 10
- ☒ group 11
- ☒ group 12
- ☒ group 13
- ☒ group 14
- ☒ group 15
- ☒ group 16

Information object addresses assigned to each group must be shown in a separate table.

Clock synchronization

(Station-specific parameter, mark "**X**" if function is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions).

- [X] Clock synchronization
- [ ] Day of week used
- [ ] RES1, GEN (time tag substituted/ not substituted) used
- [ ] SU-bit (summertime) used

Command transmission

(Object-specific parameter, mark "**X**" if function is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions).

- [X] Direct command transmission
- [ ] Direct setpoint command transmission
- [X] Select and execute command
- [ ] Select and execute setpoint command
- [ ] C_SE ACTTERM used
- [ ] No additional definition
- [ ] Short-pulse duration (duration determined by a system parameter in the outstation)
- [ ] Long-pulse duration (duration determined by a system parameter in the outstation)
- [X] Persistent output
- [X] Supervision of maximum delay in command direction of commands and setpoint commands
- [configurable] Maximum allowable delay of commands and setpoint commands

Transmission of integrated totals

(Station- or object-specific parameter, mark "**X**" if function is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions).

- ☐ Mode A: Local freeze with spontaneous transmission
- ☐ Mode B: Local freeze with counter interrogation
- ☐ Mode C: Freeze and transmit by counter-interrogation commands
- ☐ Mode D: Freeze by counter-interrogation command, frozen values reported spontaneously
- ☐ Counter read
- ☐ Counter freeze without reset
- ☐ Counter freeze with reset
- ☐ Counter reset
- ☐ General request counter
- ☐ Request counter group 1
- ☐ Request counter group 2
- ☐ Request counter group 3
- ☐ Request counter group 4

Parameter loading

(Object-specific parameter, mark "**X**" if function is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions).

- ☐ Threshold value
- ☐ Smoothing factor
- ☐ Low limit for transmission of measured values
- ☐ High limit for transmission of measured values

Parameter activation

(Object-specific parameter, mark "**X**" if function is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions).

- ☐ Act/deact of persistent cyclic or periodic transmission of the addressed object

Test procedure

(Station-specific parameter, mark "**X**" if function is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions).

☒ Test procedure

File transfer

(Station--specific parameter, mark "**X**" if function is used.

File transfer in monitor direction:

☐ Transparent file

☐ Transmission of disturbance data of protection equipment

☐ Transmission of sequences of events

☐ Transmission of sequences of recorded analogue values

File transfer in control direction:

☐ Transparent file

Background scan

(Station-specific parameter, mark "**X**" if function is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions).

☒ Background scan

Acquisition of transmission delay

(Station-specific parameter, mark "**X**" if function is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions).

■ ~~Acquisition of transmission delay~~

Definition of timeouts

Parameter	Default value	Remarks	Selected value
t_0	30s	Time-out of connection establishment	**Not applicable**
t_1	15s	Time-out of send or test APDUs	**user configurable**
t_2	10s	Time-out for acknowledges in case of no data messages $t_2 < t_1$	**user configurable**
t_3	20s	Time-out for sending test frames in case of a long idle state	**user configurable**

Maximum number of outstanding "I" format APDUs "*k*" and latest acknowledge APDUs "*w*"

Parameter	Default value	Remarks	Selected value
k	12 APDUs	Maximum difference receive sequence number to send state variable	**user configurable**
w	8 APDUs	Latest acknowledge after receiving *w* I format APDUs	**user configurable**

Portnumber

Parameter	Value	Remarks
Portnumber	2404	In all cases

Redundant connections

[2] Number "N" of redundancy group connections used

RFC 2200 suite

FC 2200 is an official Internet Standard that describes the state of standardization of protocols used in the Internet as determined by the Internet Architecture Board (IAB). It offers a broad spectrum of actual standards used on the Internet. The suitable selection of documents from RFC 2200 defined in this standard for given projects has to be chosen by the user of this standard.

[X] Ethernet 802.3

[ ] Serial X.21 interface

Setpoint Mapping

The TripSaver II Cutout-Mounted Recloser Communications Gateway provides a lengthy list of setpoints to be used by the IEC 60870-5-104 controlling station. The user can choose to map any set of setpoints in the gateway. Unmapped setpoints will be hidden and not reported to the controlling station.

Methods to Report Monitored Setpoint Data to the Controlling Station

The TripSaver II Cutout-Mounted Recloser Communications Gateway offers several configuration options to allow different monitored setpoints to be reported to the controlling station via different methods. Monitored setpoints include single point information, double point information, and measured value, short floating point number.

The gateway supports the standard IEC 60870 **Interrogation** command. If the controlling station requests a group interrogation for group 0 (station interrogation), the gateway will return all mapped setpoints of the three monitored point types. In addition, each monitored point can be configured as part of a specific interrogation group (from 1 to 16). In this case, the controlling station can issue an **Interrogation** command to retrieve just the specific interrogation group and the gateway will return only the setpoints configured in that group.

The gateway also supports the IEC 60870 cyclic/periodic reporting and background reporting features. Any measured value point can be configured to be reported via periodic reporting. The periodic reporting interval is also configurable. If any measured value points are configured for periodic reporting, the gateway will report all those points at the configured interval. Similarly, any single point information or double point information point can be configured to be reported via background reporting. The background reporting interval is also configurable. If any single point information or double point information points are configured for background reporting, the gateway will report all those points at the configured interval.

The gateway can also send monitored setpoints via spontaneous events (IEC 60870 cause of transmission set to “Spontaneous”). Each single-point information and double-point information setpoint can be configured to enable events. If a single- or double-point information setpoint has events enabled and the value changes, the gateway will immediately send a spontaneous event to the controlling station.

The gateway supports a deadband mechanism to generate spontaneous events for measured value setpoints. For each measured value setpoint, the user can configure a fixed deadband and/or percent deadband interval. If either of those is configured and the measured value changes by the configured deadband amount, the gateway will immediately send a spontaneous event to the controlling station.

Finally, the gateway also supports the IEC 60870 read command which allows the controlling station to retrieve the value of a single monitored point.

Measured Value Scaling

The gateway allows the user to configure a scaling multiplier for any measured value setpoint. The default value is "1," which will leave the measured value unchanged. If the scaling value is set to a different value, that multiplier will be applied to that measured value setpoint before it is reported to the controlling station. If fixed deadbands are enabled, the scaling factor will be applied before fixed deadbands are checked.

Single, Double Commands

The gateway supports an optional feature to retry IEC commands. By default, this behavior is disabled and any command is tried once and then discarded. However, if the feature is enabled, the user can configure a maximum number of retries and interval between retries. This behavior is configurable on a per-setpoint basis.

The gateway ignores the QU field in the Qualifier of Command, treating values of "short pulse," "long pulse," and "persistent" the same.