

Does the new Swistra Ripple Control Protocol supersede the introduction of bi-directional Communication?



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Introduction

The future introduction of Time Of Use meters will increase the customers' awareness of their consumption behaviour. Paired with useful incentives like online tracking of the used prepaid credit this system could easily supersede the introduction of expensive bi-directional reading of meters and provide means to save electricity at a very large scale.

To facilitate the introduction of TOU meters Swistec has introduced the new Swistra Ripple Control protocol which is up to 20 times faster than the DECABIT protocol. This protocol furthermore allows using Ripple Control for other new tasks like remote programming of receivers, addressing and controlling individual receivers and sending out text messages to customer's in-house displays.

Preliminary notes

Swistra is a variable Ripple Control telegram which is custom-tailored to any given installation. Thus, in case of existing audio-frequency Ripple Control systems, it allows for a smooth transition to a faster transfer rate.

The transfer rate which can be achieved with the Swistra protocol highly depends on the possibilities of the installed system technology and the necessity to ensure that the already installed Ripple Control receivers of older generations will under no circumstances be disrupted.

With a completely new installation transfer rates of 50 Bauds can be accomplished.

Enabling Technology

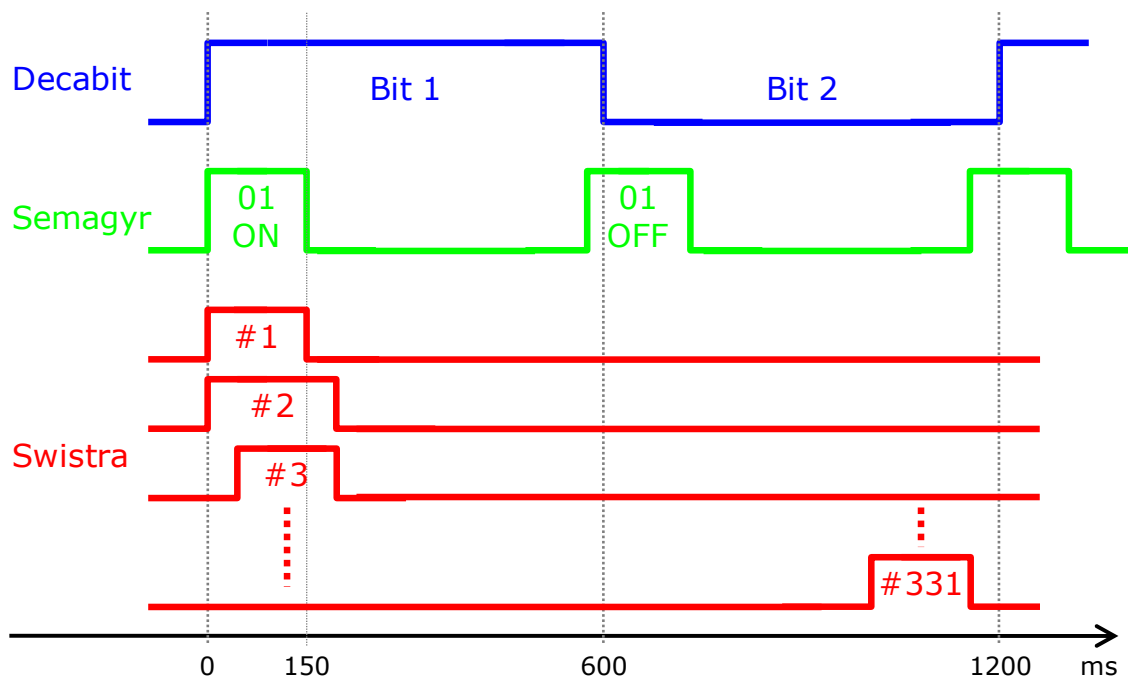
Today, modern Ripple Control receivers are equipped with software-based digital filter technology which can determine pulse edges (beginning and ending) in a good, timely resolution, doing away with the old very rough time frames in which "pulse received: yes / no" checks have been conducted.

In addition, the amplitude of the measured Ripple Control pulses can nowadays be determined with a high relative accuracy.

Example: Swistec Ripple Control receivers of the „SRE“-generation detect pulse edges with an accuracy of better than 5 milliseconds and an amplitude with a relative accuracy of better than 0.05%!

Swistra Bytecoding

For conventional ripple tracks (e.g. Semagyr) the binary information „Relay ON“ or „Relay OFF“ is coded in a way that within a timescale of approx. 1 s a ripple pulse with a duration of approx. 150 ms is being sent within one or another specified window. This means a data rate of roughly 1 Bit per second (1 Baud).



When generating and injecting ripple pulses to the network, first a minimum pulse length (typ. 110-150 ms) has to be sent. This is necessary to achieve a stable signal on the network. Second it has to be considered that there is a certain jitter on the edges of the ripple pulses in the network. This jitter is depending on the technique of transmitters and couplings. With modern transmitters we see a jitter between 5 and 10 ms, with older transistor-type transmitters it might even be 30-40 ms.

Taking these constraints into consideration, we can detect the pulse edges with an accuracy of clearly better than 50 ms. This fact is being used with Swistra by varying the pulse lengths and additionally the pulse positions within steps of 50ms.

A set of pulse/pause-sequences is being defined with respect to all the constraints mentioned before. In the same manner as was done with the Decabit track (5 out of 10 pulses), out of all possible only those pulse-pause-sequences are classified as “valid Swistra sequences”, which fulfill certain aspects of error detection and duty cycle requirements. This results in 331 possible sets (see annex) being sent during 1.15 seconds. To code a Byte only 256 of this sets are being unused. This means we are now having a data rate of approximately 1 Byte per second.

If a variation in the amplitude of the signal can be used as well (up to now only with transmitter type SRS), the time duration of a telegram can once more be reduced.

Coding of Swistra telegrams

The meaning of the transmitted information blocks is being defined independently of the definition of the pulse-pause-sequences. For often used applications (direct execution commands) the coding proposal contains pre-defined addresses and commands. These commands are attained by adding several 1.15s long Swistra sets. The same applies for often used time synchronizations. All further applications use a coding according to DIN 43861-301 („Versacom“).

Limitations

Limitations may occur due to Ripple Control receivers that are already installed in that network and that shall of course not be disturbed by the introduction of new telegrams. The flexibility of the Swistra-concept allows for modifications to the system so that Swistra-telegrams which are transmitted within networks with e.g. Decabit receivers look completely different than those which are used in networks with Semagyr receivers.

However, this cannot hide the fact that an adaptation to an old system always reduces the potential of the maximal Swistra transfer rate.

Configuration for three different system setup's:

1.) New systems or completely updated systems

For new Ripple Control systems, the maximum data rate can be achieved when pulse times as well as level rates are varied.

Completely updated systems have to comply with the following requirements:

- Swistra enabled controllers
- Optional: Even higher data rates with transmitters with two switchable voltage levels during the transmission (up to now only Swistec SRS transmitters)
- All receivers have to be Swistra enabled

Similar to the previously known start pulse, a standardizing set of pulses is sent at the beginning of each Ripple Control telegram. This standardizing pulse defines the minimal pulse length and, at the same time, the number and amplitude of the level steps that are used.

Since, with such standardizing, the absolute height of each step is being defined anew with each telegram, time varying influences (e.g. changes in the electrical network, changes in the load situation) can be eliminated.

2.) Swistra and Semagyr systems

If Swistra shall be integrated in a Semagyr system, a corresponding address selection ensures that the old Semagyr receivers are not triggered by Swistra commands. If no direct commands are used, pulse fields of variable pulse length and break duration can be used after the required Semagyr address for Swistra commands has been sent.

In order to use Swistra coding, the complete period that is not used for direct Semagyr command pulses is available. Typically this period is up to 20 seconds long.

3.) Swistra and Decabit

For the integration of Swistra into the Decabit-system, Swistra commands are being sent alongside Decabit commands. If a Decabit receiver detects a start pulse it analyzes the next 6

seconds and is then ready to receive a new command. This means that Swistra telegrams shall not be longer than 6.6 seconds. Typically, individual 4-byte blocks will be composed to longer information contents. Such a 4 byte block can well be coded in a Decabit telegram length.

New Applications with Swistra

Load control

With Swistra it is possible to do a differentiated addressing. Receivers can be addressed individually, also in the residential area. This allows for flexible group assignments under regional and thematic aspects. Instead of load shedding the electrical supply may also be limited through transmission of limiting values and/or dimming values

Metering

A potential application for Swistra is to broadcast a time of use tariff to the Swistra receiver. This time of use tariff is then transferred to a prepaid meter via a standardized meter protocol (e.g. SML, DMLS).

Moreover the tariff information may as well be displayed to an in-house display in order that the customer is always aware of the actual tariff. Moreover other information in a SMS-like format (RCMS = Ripple Control message service) may also be transferred and displayed on the in-house display.

Street Lighting

Swistra enables a better individual addressing and dimming of street lights. Flexible programming according to changing municipalities' wishes (variations in times for on/off-switching) is also possible.

In a pilot project in Germany (infra Fürth) the street lights are being dimmed in steps of 10% for a better energy efficiency and the reduction of "light pollution". A dimming of the street lighting is ideal in combination with LED-streetlights.

Load control decentralized production

With Swistra, transmissions of load commands can be achieved in a mere second, making Ripple Control even faster than it is today. Moreover the real time characteristics assure that the load is immediately switched over the whole network. With the new possibilities of distributed generation (e.g. solar, wind) Swistra can be used to gain control over this distributed generations by preventing an overload in periods of low load and high generation. Also the control of decentralized electricity storages is a task best achieved with Ripple Control.

Conclusion

To summarize, the new high-speed Swistra protocol with more functionality than existing ripple control protocols, provides the ideal solution for existing ripple control users to update their systems at relatively low cost, so as to provide additional features over and above their existing applications.

In particular, the Swistra protocol enables Time Of Use tariffs to be introduced for prepayment metering customers, without the need for expensive smart meter systems.

Swistra also enables text information to be transmitted to Customer Interface Units to provide relevant tariff information to the customers.

Annex

Swistra Pulse Pattern

#	Pulse Pattern	#	Pulse Pattern	#	Pulse Pattern
0	+++++++---+++-----	40	---+++++++---+++-----	80	++++---+++---+++-----
1	+++++++---+++-----	41	++++---+++---+++-----	81	+++---+++---+++-----
2	+++++++---+++-----	42	++++---+++---+++-----	82	---+++++++---+++-----
3	++++---+++++-----	43	+++---+++++---+++-----	83	++++---+++---+++-----
4	++++---+++++-----	44	---+++++++---+++-----	84	+++---+++---+++-----
5	+++---+++++-----	45	+++++++---+++-----	85	---+++++++---+++-----
6	+++++++---+++-----	46	++++---+++---+++-----	86	++++---+++---+++-----
7	+++++++---+++-----	47	+++---+++---+++-----	87	+++---+++---+++-----
8	+++++++---+++-----	48	---+++++++---+++-----	88	---+++++++---+++-----
9	++++---+++++-----	49	++++---+++---+++-----	89	+++++++---+++-----
10	++++---+++++-----	50	+++---+++---+++-----	90	+++---+++---+++-----
11	+++---+++++-----	51	---+++++++---+++-----	91	---+++++++---+++-----
12	+++++++---+++-----	52	+++++++---+++-----	92	+++---+++---+++-----
13	+++++++---+++-----	53	+++---+++---+++-----	93	---+++++++---+++-----
14	+++++++---+++-----	54	---+++++++---+++-----	94	+++---+++---+++-----
15	++++---+++++-----	55	+++---+++---+++-----	95	---+++++++---+++-----
16	++++---+++++-----	56	---+++++++---+++-----	96	++++---+++---+++-----
17	+++---+++++-----	57	++++---+++---+++-----	97	---+++++++---+++-----
18	+++++++---+++-----	58	---+++++++---+++-----	98	---+++++++---+++-----
19	++++---+++---+++-----	59	---+++++++---+++-----	99	---+++++++---+++-----
20	++++---+++---+++-----	60	++++---+++---+++-----	100	++++---+++---+++-----
21	+++---+++++---+++-----	61	---+++++++---+++-----	101	---+++++++---+++-----
22	---+++++++---+++-----	62	---+++++++---+++-----	102	---+++++++---+++-----
23	+++++++---+++-----	63	+++---+++++-----	103	---+++++++---+++-----
24	++++---+++---+++-----	64	---+++++++---+++-----	104	+++---+++---+++-----
25	+++---+++++---+++-----	65	---+++++++---+++-----	105	---+++++++---+++-----
26	---+++++++---+++-----	66	+++++++---+++-----	106	---+++++++---+++-----
27	+++++++---+++-----	67	++++---+++---+++-----	107	---+++++++---+++-----
28	+++---+++---+++-----	68	++++---+++---+++-----	108	+++++++---+++-----
29	---+++++++---+++-----	69	+++---+++---+++-----	109	++++---+++---+++-----
30	++++---+++---+++-----	70	---+++++++---+++-----	110	++++---+++---+++-----
31	---+++++++---+++-----	71	++++---+++---+++-----	111	+++---+++---+++-----
32	++++---+++---+++-----	72	++++---+++---+++-----	112	---+++++++---+++-----
33	---+++++++---+++-----	73	+++---+++---+++-----	113	++++---+++---+++-----
34	+++---+++---+++-----	74	---+++++++---+++-----	114	++++---+++---+++-----
35	---+++++++---+++-----	75	++++---+++---+++-----	115	+++---+++---+++-----
36	+++++++---+++-----	76	++++---+++---+++-----	116	---+++++++---+++-----
37	++++---+++---+++-----	77	+++---+++---+++-----	117	++++---+++---+++-----
38	++++---+++---+++-----	78	---+++++++---+++-----	118	++++---+++---+++-----
39	+++---+++---+++-----	79	+++++++---+++-----	119	+++---+++---+++-----

#	Pulse Pattern	#	Pulse Pattern	#	Pulse Pattern
120	-----+++++++-----+++--	170	+++---+++++-----+++	220	+++-----+++++---+++
121	+++++-----+++---+++--	171	---+++++++-----+++	221	---+++-----+++++---+++
122	---+++++---+++---+++--	172	+++++---+++-----+++	222	---+++-----+++++---+++
123	+++++-----+++++---+++--	173	+++++---+++++-----+++	223	-----+++---+++++---+++
124	---+++++---+++++---+++--	174	+++---+++++-----+++	224	-----+++---+++++---+++
125	+++-----+++++---+++--	175	---+++++++-----+++	225	-----+++++++---+++
126	---+++---+++++---+++--	176	+++++---+++-----+++	226	+++++---+++-----+++++
127	-----+++++++---+++--	177	+++++---+++-----+++	227	+++---+++-----+++++
128	+++++++-----+++++---	178	+++---+++++-----+++	228	---+++++++-----+++++
129	+++++---+++-----+++++---	179	-----+++++++-----+++	229	+++++---+++-----+++++
130	+++---+++++-----+++++---	180	+++++---+++-----+++	230	+++---+++++-----+++++
131	---+++++++-----+++++---	181	---+++++---+++-----+++	231	---+++++++-----+++++
132	+++++---+++-----+++++---	182	+++++---+++++-----+++	232	+++++---+++-----+++++
133	+++---+++++-----+++++---	183	---+++++---+++++-----+++	233	+++---+++++-----+++++
134	-----+++++++-----+++++---	184	+++---+++++-----+++	234	-----+++++++-----+++++
135	+++++---+++-----+++++---	185	---+++---+++++-----+++	235	+++++---+++-----+++++
136	+++---+++++-----+++++---	186	-----+++++++-----+++	236	---+++++---+++-----+++++
137	-----+++++++-----+++++---	187	+++++---+++-----+++	237	+++---+++++-----+++++
138	+++++---+++-----+++++---	188	---+++++---+++-----+++	238	---+++---+++++-----+++++
139	---+++++---+++-----+++++---	189	-----+++++---+++-----+++	239	-----+++++++-----+++++
150	+++-----+++---+++++---	200	-----+++++---+++-----+++	240	+++++---+++-----+++++
151	---+++++---+++---+++++---	201	+++++---+++++-----+++	241	---+++++---+++---+++++---
152	-----+++++++---+++++---	202	---+++++---+++++-----+++	242	---+++++---+++---+++++---
153	+++++-----+++++---	203	---+++++---+++++-----+++	243	+++-----+++++---
154	---+++++-----+++++---	204	-----+++++---+++++---	244	---+++---+++++---
155	-----+++++++-----+++++---	205	+++-----+++++---	245	---+++++---+++---+++++---
156	-----+++++++-----+++++---	206	---+++---+++++---	246	-----+++++++---+++++---
157	-----+++++++-----+++++---	207	---+++---+++++---	247	+++++-----+++---+++++---
158	+++++-----+++++---	208	-----+++---+++++---	248	---+++---+++---+++++---
159	---+++++-----+++++---	209	-----+++++++-----+++	249	---+++++---+++---+++++---
160	---+++++-----+++++---	210	+++++-----+++---+++	250	-----+++++---+++---+++++---
161	---+++++-----+++++---	211	---+++++---+++---+++	251	+++-----+++++---
162	-----+++++---+++++---	212	---+++++---+++---+++	252	---+++---+++++---
163	+++-----+++++---	213	---+++++---+++---+++	253	---+++++---+++---+++++---
164	---+++---+++++---	214	-----+++++---+++---+++	254	---+++---+++++---
165	---+++---+++++---	215	+++++-----+++---+++	255	-----+++++++---+++++---
166	-----+++---+++++---	216	---+++---+++---+++	256	+++++-----+++---+++
167	-----+++---+++++---	217	---+++++---+++---+++	257	---+++++---+++---+++
168	+++++---+++-----+++	218	-----+++++---+++---+++	258	---+++++---+++---+++
169	+++++---+++++-----+++	219	-----+++++---+++---+++	259	---+++++---+++---+++

