

The six types of safety message are:

- 1 or 2 byte Single-Cast (See section 2-1.7.1.9)
- 1 or 2 byte Multi-Cast DeviceNet (See section 2-1.7.1.10)
- 1 or 2 byte Multi-Cast Non-DeviceNet (See section 2-1.7.1.11)
- 3 to 250 byte Single-Cast (See section 2-1.7.1.12)
- 3 to 250 byte Multi-Cast DeviceNet (See section 2-1.7.1.13)
- 3 to 248 byte Multi-Cast Non-DeviceNet (See section 2-1.7.1.14)

The following table shows which Sections are used within the various message types:

**Table 2-1.2 Connection Sections and Message Types**

Safety Connection Format			Data Message <sup>2</sup>				Time Coordination Message <sup>2</sup>	Time Correction Message <sup>2</sup>
Data Size	Safety Connection Type	Network Hop Type		1 or 2 byte data section	3 to 250 byte data section	Time Stamp section <sup>1</sup>	Time Correction Section	Time Coordination Section
1 or 2 bytes	Single-Cast	All		X		X <sup>1</sup>		X
	Multi-cast	DeviceNet		X		X <sup>1</sup>		X
		Non-DeviceNet		X		X <sup>1</sup>	X	X
3 to 250 Bytes	Single-cast	All			X	X <sup>1</sup>		X
3 to 248 Bytes	Multi-cast	DeviceNet			X	X <sup>1</sup>		X
	Multi-cast	Non-DeviceNet			X	X <sup>1</sup>	X	X

1 Base format has independent section for Time Stamp; it is part of the data section in the Extended format

2 Message can use either Base or Extended format.

Originators and Targets shall follow selection criteria shown in Table 2-1.3 for the usage of the Base and Extended Formats.

### Deprecation of the Base Format

The Base Format is deprecated from CIP Safety. CIP Safety requires that only the extended format be used. Originators can optionally support the Base Format for backward compatibility. Target-only devices will be tested for Base Format not supported.

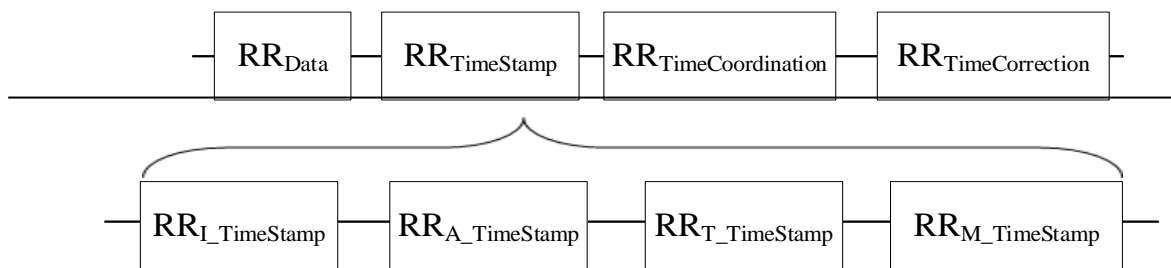
There will be a grace period to allow for target-only device(s) to make this transition. The grace period will run from 2021-01-01 to 2022-01-01. During that time target-only device(s) seeking a new Declaration of Conformity from ODVA without deprecation will be given a conformance warning. After 2022-01-01 target-only device(s) which have not deprecated the base format will not be able to obtain a new Declaration of Conformity from ODVA.

## 2-8 Network PFH of Extended Format

This section describes the principal method used for the determination of the PFH value for each safety communication channel using Extended Format. Note that Base Format has been deprecated so network PFH is not calculated for Base Format. The safety communication channel PFH must meet the 1% rule from the IEC 61784-3 standard. CIP safety network is targeted at systems up to SIL 3, therefore the safety communication channel PFH must not be more than 10<sup>-9</sup> per hour.

CIP safety network protocol consists of four parts, safety data, time stamp information, the Multicast time correction information, and the time coordination ping response. Each of these parts has its own protection that contributes to the final network PFH. The protection of each part covers four types of errors: integrity error (I), authenticity error (A), timeliness error (T) and masquerade error (M). The authenticity error, timeliness error and masquerade error are required to be considered in safety communication channel PFH calculation started from IEC 61784-3 Edition 4.

**Figure 2-8.1 Network Protocol Reliability Block Diagram (RBD)**



As shown in Figure 2-8.1, the residual error rate per hour of each part can be divided into four sub residual error rate per hour elements which are corresponding to four error types. From the RBD in Figure 2-8.1, the equation for the total network residual error rate per hour of the safety communication channel is:

**Equation 2-8.1 Overall Network Residual Error Rates**

$$\begin{aligned}
 \lambda_{SC} &= RR_{Data} + RR_{TimeStamp} + RR_{TimeCoordination} + RR_{TimeCorrection} \\
 &= RR_{I\_Data} + RR_{A\_Data} + RR_{T\_Data} + RR_{M\_Data} \\
 &\quad + RR_{I\_TimeStamp} + RR_{A\_TimeStamp} + RR_{T\_TimeStamp} + RR_{M\_TimeStamp} \\
 &\quad + RR_{I\_TimeCoordination} + RR_{A\_TimeCoordination} + RR_{T\_TimeCoordination} + RR_{M\_TimeCoc} \\
 &\quad + RR_{I\_TimeCorrection} + RR_{A\_TimeCorrection} + RR_{T\_TimeCorrection} + RR_{M\_TimeCorrection}
 \end{aligned}$$

where RRI is residual error rate of integrity errors, RRA is residual error rate of authenticity errors, RRT is residual error rate of timeliness errors and RRM is residual error rate of masquerade errors.

The final network PFH value of the safety communication channel depends on how it is configured, e.g., single-cast or multicast, EPI, Timeout Multiplier and Ping Interval EPI Multiplier settings. With all settings in valid ranges as defined within this specification, the worst case PFH value the safety communication channel ( $\lambda_{SC}$ ) using Extended Format is 5.00E-10 per hour.

FRS385 The overall PFH of each CIP Safety device shall incorporate the worst-case network PFH value 5.00E-10 per hour. There is no need for additional Network PFH calculation.