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HART

COMMUNICATION PROTOCOL

Common Tables Specification

HCF_SPEC-183, Revision 22.0

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Use of imperatives in HART Specifications

The key words (imperatives) "must", "required", "shall", "should", "recommended", "may", and "optional" when used in this document are to be interpreted as follows:

Must	**Must**, **Shall**, or **Required** denotes an absolute mandatory requirement. For example, "All HART Field Devices must implement all Universal Commands"
Should	**Should** or **Recommended** indicates a requirement that, given good cause/reason, can be ignored. However, the consequences of ignoring the requirement must be fully understood and well justified before doing so.
May	**May** or **Optional** identifies a requirement that is completely optional and can be supported at the discretion of the implementation. May can be used to identify optional Host Application or Master functionality and, when this is the case, does not imply the function is optional in Field Devices.

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1   SCOPE

The *Common Tables Specification* is an Application Layer specification and, accordingly, builds on the Application Layer Requirements found in the *Command Summary Specification.* Conformance to all requirements of the *Command Summary Specification* is a prerequisite to conforming to this specification.

The *Common Tables Specification* contains a collection of standard lookup tables (e.g., Engineering Units, Manufacturer Identification Code, etc.) used throughout the Protocol. Commands defined by the HART Protocol and device-specific commands often reference these tables. When a Common Table is referenced by a command, the table or subset of the table must be used exactly as specified. Furthermore, undefined (i.e., unlisted) codes must not be used in any device.

In addition to listing Common Tables, this specification contains the rules that must be followed when modifying this specification, adding enumerations to an existing Common Table or defining new tables. As required by the *Command Summary Specification*, once a code has been defined, the term and its corresponding code (enumeration) must not be changed or deleted.

2   REFERENCES

2.1   HART Field Communications Protocol Specifications

These documents published by the HART Communication Foundation are referenced throughout this specification:

HART Smart Communications Protocol Specification. HCF_SPEC-12

Data Link Layer Specification. HCF_SPEC-81

Command Summary Specification. HCF_SPEC-99

Universal Command Specification. HCF_SPEC-127

Common Practice Command Specification. HCF_SPEC-151

Device Families Command Specification. HCF_SPEC-160

2.2   Related Documents

The following are applicable NAMUR documents:

NAMUR. *Self-Monitoring and Diagnosis of Field Devices*. NE 107

3   DEFINTIONS

Terms used in this document and defined in *HART Field Communications Protocol Specification* include Enumerations, Fixed Current Mode, Unit Code, Device Variable, Master, and Slave

4   SPECIFICATION CONTROL

The Common Tables Specification is designed to allow the addition of new enumerations. These enumerations are applicable to all slave devices and may be updated frequently. As a result, the change control procedures used by other specifications do not apply to the Common Tables Specification. In other words, balloting of a new or revised Common Tables Specification is not practical.

This section defines procedures and requirements that govern the addition of a table to this specification. Therefore the modification of a table included in a revision of this specification. These requirements are designed to:

Ensure the technical excellence of each table;

Provide a fair, open and objective basis for the development of additional tables;

Alignment of the tables with Protocol requirements and practices; and

Allow access and participation by all interested parties.

Any changes to this specification, other than additions or changes to a specific table must follow the normal change procedures as defined in the *HART Smart Communications Protocol Specification*.

Common Tables Specification Revision 13.1 must be balloted and follow the normal process for HART Specifications as defined in *HART Field Communications Protocol Specification*.

4.1   Revision Numbers
As per normal Protocol requirements, The *Common Tables Specification* has a major and minor revision number. As a specification is changed, the major and minor revision numbers are incremented as follows:

The addition of a new table and/or new enumerations to existing tables is a functional change to this specification. The major revision number must be incremented and the minor revision number reset to one.

Minor changes to an enumeration label where the meaning does not change and/or corrections to misspelled words shall be considered a non-functional change to this specification and the minor revision number must be incremented.

Any other change to this specification must follow the revision numbering and change control procedures found in the HART Smart Communications Protocol Specification.

4.2   Additions to Common Tables
Any HCF member company or the HCF staff may submit request proposals for the additions to the existing Common Tables. All Request proposals must state the tables affected, changes envisioned and the benefits the changes would provide.

All requests are maintained in a database. This database shall track who and how often specific enumerations are requested.

Note: The frequency of an enumeration request is one acceptance criteria used by the Common Tables Committee.

Proposals are forwarded to members of the Common Tables Committee for review. The Common Tables Committee may reject a proposal, modify the proposal or accept the proposal. Complete and accepted proposals are collected for inclusion in the next revision of the *Common Tables Specification*. Once the Request Proposal for a particular enumeration is approved, the actual numeric value for the enumeration is chosen by members of the Common Tables Committee.

4.2.1   Additions to Common Table 8, Manufacturer Identification Codes
Any additions to Common Table 8, Manufacturer Identification Codes must be performed by the HCF Staff.

4.2.2   Device Identification Code Registration
The owner of a Manufacturer ID may register his device types with the HCF and have them included in the *Common Tables Specification*. Requests for these additions to the specification are made following normal requirements and procedures. The assignment of device type codes must meet the following requirements:

The device type codes shall be assigned based on the rules specified in the *Data Link Layer Specification.*

All devices shall follow the revision rules in the *Command Summary Specification.*

4.2.3   Engineering Unit Code Selection
When evaluating unit codes requests, the Common Tables Committee shall make assignments on the following criteria:

Unit codes that are common to more than one Device Family and are approved for selection shall be assigned in the ranges from 1- 169 and 220 – 239.

Unit codes that are Device Family specific and are approved for selection shall be assigned in the Unit Code Expansion areas of 170 – 219 for the appropriate Unit Code Expansion Table.

The Unit Code Expansion Tables include all the existing enumerations from Table 2 (1 - 169 and 220 – 239) along with the Unit Code Expansion areas of 170 – 219.

Unit codes from 240 – 249 are reserved for manufacturer specific definitions and must not be used in the assignment of Unit Codes.

4.3   Releasing a Common Tables Specification Revision

Accepted change proposals are collected and periodically a new revision of the *Common Tables Specification* is generated. A new revision is (typically) released once or twice a year. The actual release must complete the following steps:

A proposed revision of the Common Tables Specification is generated and all approved change proposals are incorporated.

The proposed revision is forwarded to all members of the Common Tables Committee for review and approval.

Once delivery of the proposed revision is confirmed, committee members have 15 working days to approve or disapprove the modifications. All rejections must include conditions for acceptance. No response will be considered approval by that committee member.

Unanimous approval by Common Tables Committee membership is required to release the *Common Tables Specification* revision.

4.4   Common Tables Committee

The Executive Committee of the HCF shall appoint the Common Tables Committee to control changes to this specification. The Common Tables Committee shall consist of three to four members. The member should have a minimum of 2 years work experience with the Application Layer of the Protocol. The Common Tables Committee shall:

Review all proposed changes to the *Common Tables Specification*;

Ensure the *Common Tables Specification* change procedures are followed;

Determine Common Tables Specification advancement;

Document Committee actions; and

Verify the Common Tables Specification adheres to all requirements of the HART Protocol.

The Chair must keep accurate and complete records of all meetings, design decisions and discussions. The Chair is responsible for publishing meeting minutes. All e-mail and other correspondence must be archived and available to the HCF membership. Common Tables Committee actions may not be implemented prior to the publication of the meeting minutes documenting the action being published to the HCF membership.

5   COMMON TABLES
The following sections list the enumerations for each of the common tables.

5.1   Table 1. Expanded Device Type Codes
Table 1. defines the expanded device types enumerations of devices.

Expanded Device Code (Hex)	Description	Company Name
0304	NEWTHERMOX	Ametek
0A01	TRI20	Brooks Instrument
0A02	38XXVA	Brooks Instrument
0A03	99XXOVAL	Brooks Instrument
0A04	QUANTIM	Brooks Instrument
0D14	3400 Series Gas USM	Daniel Industries
0D15	3410 Series Gas USM	Daniel Industries
0D28	3800 Series Liquid USM	Daniel Industries
0D29	3810 Series Liquid USM	Daniel Industries
0E01	HT	Delta Controls
1103	FMU860	Endress & Hauser
1104	FMU861	Endress & Hauser
1105	FMU862	Endress & Hauser
1106	FMR130/Micropilot	Endress & Hauser
1107	CERABS /Cerabar S	Endress & Hauser
1108	FEC12	Endress & Hauser
1109	DELTBS/Deltabar S	Endress & Hauser
110A	FMU231/FMU13x	Endress & Hauser
110B	DELTAPS/ Deltapilot	Endress & Hauser
110C	FMR23x	Endress & Hauser
110D	FMP200	Endress & Hauser
110E	Cerabar M	Endress & Hauser
110F	FMR2xx	Endress & Hauser
1110	FMR53x	Endress & Hauser
1111	FMU4x	Endress & Hauser
1112	FMP4x	Endress & Hauser
1113	FMG60	Endress & Hauser
1114	NRF590	Endress & Hauser
1117	DeltabarS	Endress & Hauser
1118	CerabarS	Endress & Hauser
1119	Cerabar M 5x	Endress & Hauser
111A	DeltapilotS	Endress & Hauser
111B	FMU9x	Endress & Hauser
111D	FMI5x	Endress & Hauser
111E	FMR25x	Endress & Hauser
111F	FMR54x	Endress & Hauser
1120	FMP4x I	Endress & Hauser
1121	Deltabar M 5x	Endress & Hauser

Expanded Device Code (Hex)	Description	Company Name
1122	Levelflex FMP5x	Endress & Hauser
1123	Deltapilot M 5x	Endress & Hauser
1124	Waterpilot 2x	Endress & Hauser
1132	PROMAG33	Endress & Hauser
1133	PROWIRL70	Endress & Hauser
1134	PROMASS63	Endress & Hauser
1135	PROMAG39	Endress & Hauser
1136	PROMAG35S	Endress & Hauser
1137	PROWIRL77	Endress & Hauser
1139	PROMASS60	Endress & Hauser
1140	PROSON F	Endress & Hauser
1141	PROMAG50	Endress & Hauser
1142	PROMAG53	Endress & Hauser
1143	PROMAG51	Endress & Hauser
1144	PROMAG55	Endress & Hauser
1145	PROMAG10	Endress & Hauser
1146	PROMAG23	Endress & Hauser
1149	Cubemass DCI	Endress & Hauser
1150	PROMASS80	Endress & Hauser
1151	PROMASS83	Endress & Hauser
1152	PROMASS84	Endress & Hauser
1153	PROMASS40	Endress & Hauser
1154	Promass TB2	Endress & Hauser
1155	CNGmass DCI	Endress & Hauser
1156	PROWIRL72	Endress & Hauser
1157	PROWIRL73	Endress & Hauser
1158	P_FLOW90	Endress & Hauser
1159	P_FLOW93	Endress & Hauser
115A	Prosonic Flow B 200	Endress & Hauser
1161	P_FLOW92	Endress & Hauser
1162	P_FLOW91	Endress & Hauser
1164	AT70	Endress & Hauser
1165	T-MASS65	Endress & Hauser
1178	TMD832	Endress & Hauser
1179	TMD833	Endress & Hauser
117C	TMD842	Endress & Hauser
118C	MyPro Ph	Endress & Hauser
118D	MyPro LFC	Endress & Hauser
118E	MyPro LFI	Endress & Hauser
119C	Liquiline CM44x	Endress & Hauser
11B5	NMT530	Endress & Hauser
11B6	NMS530	Endress & Hauser
11C8	TMT182	Endress & Hauser

Expanded Device Code (Hex)	Description	Company Name
11C9	TMT122	Endress & Hauser
11CA	TMT162	Endress & Hauser
11CB	TMT142	Endress & Hauser
11CC	TMT82	Endress & Hauser
1207	50XM2000	ABB
1208	50XE4000	ABB
120E	50VT1000	ABB
120F	50VM1000	ABB
1219	50XM1000	ABB
121A	50SM1000	ABB
1242	PTH	ABB
1250	TB82PH Ph	ABB
1251	TB82PH ORP	ABB
1252	TB82PH pION	ABB
1253	TB82PH IConc	ABB
1254	TB82EC COND	ABB
1255	TB82EC CONC	ABB
1256	TB82TE COND	ABB
1257	TB82TE CONC	ABB
1258	TB82TC COND	ABB
1259	TB82TC CONC	ABB
1300	Position Xmitter	Fisher Controls
1303	DVC6000	Fisher Controls
1304	DLC3010	Fisher Controls
1305	DVC2000	Fisher Controls
1308	4320 Position Monitor	Fisher Controls
1401	MAG2	Foxboro
1402	IASPT Premium 2	Foxboro
1403	876 CR	Foxboro
1404	876 EC	Foxboro
1405	876 pH	Foxboro
1407	RTT30	Foxboro
1408	ECS Pressure	Foxboro
140A	RTT80	Foxboro
141D	IMV31	Foxboro
141E	Vortex 84	Foxboro
1428	IMT96	Foxboro
1429	IMT25	Foxboro
142E	I/A Pressure	Foxboro
142F	IMV 25/30	Foxboro
1430	875PH	Foxboro
1433	ITVORTEX	Foxboro
1434	CFT50	Foxboro

Expanded Device Code (Hex)	Description	Company Name
1435	875CR	Foxboro
1436	875EC	Foxboro
1438	RTT15	Foxboro
147D	CFT 30 x	Foxboro
1501	FCX-A/C	Fuji
1502	FCX-A2/C2	Fuji
1581	FRC	Fuji
1603	TEU 471	ABB
1604	TEU 421	ABB
1605	TEU 211	ABB
1606	TS 11	ABB
1608	TH 02	ABB
1640	TZID	ABB
1641	TZIDC	ABB
1685	AS800	ABB
1687	Contrac	ABB
1701	ST3000	Honeywell
1702	STT25T	Honeywell
1703	HWFLOW/Mage W Plus	Honeywell
1704	STT25H	Honeywell
1705	HERCULINE	Honeywell
1706	SmartCET	Honeywell
1707	STT17H	Honeywell
1708	ST2500	Honeywell
1709	STT25S	Honeywell
1729	XNX	Honeywell
1750	TWM9000	Honeywell
170A	SmartCET CET5500M	Honeywell
170B	STT25H6	Honeywell
170C	STT25T6	Honeywell
1729	XNX	Honeywell
1750	TWM9000	Honeywell
1751	TWC9000	Honeywell
1754	TWV9000	Honeywell
1755	TWM1000	Honeywell
1756	SmartLine Radar	Honeywell
1757	SmartLine TDR	Honeywell
1908	4050	Thermo MeasureTech
1909	3680 Dens	Thermo MeasureTech
190A	4790	Thermo MeasureTech
190B	Accu-Pulse Pro	Thermo MeasureTech
190F	3280 Steam qual	Thermo MeasureTech
1A01	KSX	ABB

Expanded Device Code (Hex)	Description	Company Name
1A02	600T	ABB
1A03	ABB-2600T 268	ABB
1A04	ABB-2600T 262/264	ABB
1A05	2600T-364	ABB
1A07	2600T 266 Pressure	ABB
1A08	KST	ABB
1A09	TH01	ABB
1A0A	658T	ABB
1A0B	TTX300 series	ABB
1A0C	652/653S	ABB
1A0D	TTX200	ABB
1A0F	665	ABB
1A10	Deltapi KT	ABB
1A18	MagMaster	ABB
1A1A	FVS4000	ABB
1A1B	VA Master FAM540	ABB
1A1C	FMT500iG	ABB
1A1D	FSM4000	ABB
1A1E	FEX300	ABB
1A1F	FEX100	ABB
1A21	2600PH	ABB
1A23	TB82PH-Combined	ABB
1A24	TB82EC-Combined	ABB
1A25	TB82TE-Combined	ABB
1A26	TB82TC-Combined	ABB
1A27	FMT300/350/400	ABB
1A29	UFTE-PA	ABB
1A2A	UFTE-FF	ABB
1A30	APA592PH	ABB
1A31	ACA592EC	ABB
1A32	ACA592TE	ABB
1A33	ACA592TC	ABB
1A34	AZ200/300	ABB
1A63	CMxx ControlMaster	ABB
1A89	263/265, 2000T	ABB
1A8A	2600T 267/269/2010TC	ABB
1A8C	261	ABB
1A8D	EDP300	ABB
1A8E	2600T 266 Multivariable	ABB
1A99	NHU200-WL	ABB
1A9B	TSP3xx EnergyHarvester	ABB
1D01	B6U	M-System Co
1D02	B3HU	M-System Co

Expanded Device Code (Hex)	Description	Company Name
1D03	27HU	M-System Co
1F07	9712 Mass flo	Micro Motion
1F14	9720 Mass flo	Micro Motion
1F15	9739 Mass flo	Micro Motion
1F16	MVD Series 9739	Micro Motion
1F1E	9701	Micro Motion
1F24	MVD Series 2000 Config I/O	Micro Motion
1F25	MVD Series 1000 Config I/O	Micro Motion
1F26	MVD Series 2000 IS Output	Micro Motion
1F27	MVD Series 1000 IS Output	Micro Motion
1F29	MVD Series 1000 Analog Output	Micro Motion
1F2A	MVD Series 2000 Analog Output	Micro Motion
1F34	2400S Mass flo	Micro Motion
1F3A	2200S Analog	Micro Motion
1F41	MVD Series 3000	Micro Motion
2001	TRZ	Moore Industries
2003	THZ	Moore Industries
2004	THZ2	Moore Industries
2005	HTZ	Moore Industries
2006	TCM	Moore Industries
2007	888	Moore Industries
2101	340 A	PRIME Measurement Products
2102	340 B	PRIME Measurement Products
2103	344	PRIME Measurement Products
2105	330	PRIME Measurement Products
2106	340 A2	PRIME Measurement Products
2007	888	Moore Industries
2108	340 B2	PRIME Measurement Products
2109	344 2	PRIME Measurement Products
210A	340 S	PRIME Measurement Products
210B	343	PRIME Measurement Products
210C	760D Valvepac	PRIME Measurement Products
210D	345	PRIME Measurement Products
2502	X96 D	Ronan
2503	X96 L	Ronan
2504	X96 W	Ronan
2505	X96 LD	Ronan
2506	X99 MD	Ronan
2601	3051	Rosemount
2602	3044 Temp	Rosemount
2603	1151	Rosemount
2604	Magmeter	Rosemount
2605	2001	Rosemount

Expanded Device Code (Hex)	Description	Company Name
2606	3051C	Rosemount
2607	mass flow 9712	Rosemount
2608	4050	Rosemount
2609	density 3680	Rosemount
260A	ph 1054	Rosemount
260B	3001L HTG	Rosemount
260C	Mag HS	Rosemount
260D	3044C Temp	Rosemount
260E	3001C HTG	Rosemount
260F	3051C LP	Rosemount
2610	Vortex	Rosemount
2611	3201 SAM	Rosemount
2612	1152	Rosemount
2613	3202 SAM	Rosemount
2614	3001S HTG	Rosemount
2615	3095FT	Rosemount
2616	3095MV	Rosemount
2617	544 Temp	Rosemount
2618	644 Temp	Rosemount
2619	3144 Temp	Rosemount
261A	3244 Temp	Rosemount
261B	3700	Rosemount
261C	3750	Rosemount
261D	Tri-Loop	Rosemount
261E	3095C	Rosemount
261F	3095MM	Rosemount
2620	3701	Rosemount
2621	3300	Rosemount
2622	3702ASU	Rosemount
2623	2088 Smart	Rosemount
2624	ProBar	Rosemount
2625	Mass ProBar	Rosemount
2626	ProV	Rosemount
2627	2090 Smart	Rosemount
2628	ProBar UC	Rosemount
2629	2055D	Rosemount
262A	3095PV	Rosemount
262D	Sentry	Rosemount
262F	ProPlate UC	Rosemount
2636	1810	Rosemount
2637	8712D	Rosemount
2638	4600	Rosemount
263A	8800D	Rosemount

Expanded Device Code (Hex)	Description	Company Name
263B	248 Temperature	Rosemount
263C	8732D	Rosemount
263F	8600D	Rosemount
2640	2088LP	Rosemount
2641	5600 Radar Level	Rosemount
2642	951	Rosemount
2643	5400	Rosemount
2644	3051S SIS	Rosemount
2645	3144P SIS	Rosemount
2647	4500	Rosemount
2649	3051SMV with Fully Compensated Mass and Energy Flow	Rosemount
264A	3051S Diag	Rosemount
264B	3051SMV Direct Process Variable Output	Rosemount
264E	Wireless Gateway	Rosemount
2650	3100	Rosemount
2651	5300	Rosemount
2653	848T Wireless	
2655	2051	Rosemount
2656	2051LP	Rosemount
2657	8712E	Rosemount
2658	648 WirelessHART	Rosemount
2659	3051S WirelessHART	Rosemount
265A	702 Wireless Discrete Transmitter	Rosemount
265E	3051S	Rosemount
2662	METRAN-150	Metran
266B	3440	Rosemount
266D	Metran-75	Metran
2680	Generic	Rosemount
2700	900 Densitometer	Peek Measurement
2801	NEXGEN	Actaris Neptune
2A01	MICRO K	Siemens
2A02	SITRANS L Level	Siemens
2A03	SIPAN pH	Siemens
2A04	SITRANS FUS	Siemens
2A05	SIPAN LF	Siemens
2A06	SIPAN O2	Siemens
2A07	SITRANS LR	Siemens
2A0A	SITRANS P HS	Siemens
2A0B	SITRANS P DS	Siemens
2A0C	SITRANS P ES	Siemens
2A0D	SITRANS P MS	Siemens
2A12	SITRANS TK H	Siemens

Expanded Device Code (Hex)	Description	Company Name
2A13	SITRANS TH300	Siemens
2A15	SIPART PS2	Siemens
2A16	SITRANS FM	Siemens
2A17	SITRANS FVA	Siemens
2A18	SITRANS FM MAGFLO	Siemens
2A19	SITRANS FC MASSFLO	Siemens
2A1A	SITRANS FM IT2 / TM2	Siemens
2A1D	SITRANS P300	Siemens
2A1F	SITRANS TR300	Siemens
2A20	SITRANS VP300	Siemens
2A23	SITRANS P500	Siemens
2A24	SITRANS LR560	Siemens
2C02	AP3100	Toshiba
2C03	AP3110	Toshiba
2C04	AP3120	Toshiba
2C05	AP3140	Toshiba
2C06	AP3150	Toshiba
2C07	AP3170	Toshiba
2C08	AP3180	Toshiba
2C09	AP3190	Toshiba
2C0A	LF220	Toshiba
2E06	2081 Ph	Rosemount Analytical
2E07	2081 Cond	Rosemount Analytical
2E0A	2054 Ph	Rosemount Analytical
2E0B	2054 Cond	Rosemount Analytical
2E0C	Oxymitter 4000	Rosemount Analytical
2E0D	WC_3000	Rosemount Analytical
2E0E	3081FG	Rosemount Analytical
2E0F	OPM-2000R	Rosemount Analytical
2E10	OCX-4000	Rosemount Analytical
2E14	3081Ph	Rosemount Analytical
2E15	3081C	Rosemount Analytical
2E16	3081-81con	Rosemount Analytical
2E17	3081-81T	Rosemount Analytical
2E18	5081A	Rosemount Analytical
2E19	5081C	Rosemount Analytical
2E1A	5081Ph	Rosemount Analytical
2E1B	Xmt A	Rosemount Analytical
2E1C	Xmt C/T	Rosemount Analytical
2E1D	Xmt Ph	Rosemount Analytical
2E1E	5081FG	Rosemount Analytical
2E1F	6081-P Wireless pH/ORP	Rosemount Analytical
2E20	6081-C Wireless Conductivity	Rosemount Analytical

Expanded Device Code (Hex)	Description	Company Name
2E21	1066	Rosemount Analytical
2E2B	XS-O2	Rosemount Analytical
2E3A	6888-O2	Rosemount Analytical
2E50	54Ph/ORP	Rosemount Analytical
2E51	54Ec	Rosemount Analytical
2E52	52epH/ORP	Rosemount Analytical
2E53	54Ea	Rosemount Analytical
2E55	1056	Rosemount Analytical
2E56	Model 56	Rosemount Analytical
2F01	PSMART	Metso Automation
2F3C	SMARTPULP	Metso Automation
2F3D	SMARTLX	Metso Automation
2F3E	MCAi	Metso Automation
2F3F	SMARTLC	Metso Automation
2F40	MCA	Metso Automation
3001	Logix 12xx	Flowserve
3002	Kämmer C2100	Flowserve
3003	Logix 520	Flowserve
3004	Logix3200-IQ	Flowserve
3005	Logix3200MD	Flowserve
3006	Logix520MD	Flowserve
3201	970	Viatran
322E	I/A Pressure	Viatran
3601	MagneW	Azbil
3602	ST3000	Azbil
3603	SVP	Azbil
3604	ThermoPlus ATT	Azbil
3605	PTG	Azbil
3608	MagneW 2W	Azbil
360C	MAGNEW4W	Azbil
360D	AT9000	Azbil
360E	GASCVD	Azbil
360F	AVP700	Azbil
3610	AVP700-SIS	Azbil
3614	SVP-V2	Azbil
3701	YEWFLO	Yokogawa
3702	YT200	Yokogawa
3703	UNICOM	Yokogawa
3704	EJA	Yokogawa
3705	ADMAG AE	Yokogawa
3706	AM11	Yokogawa
3707	ADMAG SE	Yokogawa
3708	YTA	Yokogawa

Expanded Device Code (Hex)	Description	Company Name
370A	YTA70E	Yokogawa
370B	DYF	Yokogawa
370C	ZR202	Yokogawa
370D	ZR402	Yokogawa
3714	ISC202	Yokogawa
3715	PH202	Yokogawa
3716	SC202	Yokogawa
3718	DO202	Yokogawa
3727	PH150	Yokogawa
3728	SC150	Yokogawa
372B	PH450	Yokogawa
372C	SC450	Yokogawa
372D	ISC450	Yokogawa
373C	YTA70E/Z	Yokogawa
3740	ROTAMASS	Yokogawa
3741	RAMC	Yokogawa
3742	RCCT_F3	Yokogawa
3750	AXFA11	Yokogawa
3751	EJX	Yokogawa
3752	AXFA14	Yokogawa
3753	AV550G	Yokogawa
3754	EJX-MV	Yokogawa
3757	AXR	Yokogawa
3758	FLXA21-PH	Yokogawa
3759	LXA21-SC	Yokogawa
375A	FLXA21-ISC	Yokogawa
375B	FLXA21-DO	Yokogawa
375C	EJA-NEXT	Yokogawa
3B13	4301	Mobrey
3B14	3301	Mobrey
3B15	MSP100	Mobrey
3B21	3300	Mobrey
3B29	MLT100	Mobrey
3B2A	4291	Mobrey
3B2B	MSM400	Mobrey
3B2C	MSL600	Mobrey
3B2D	MCU900	Mobrey
3B2E	MSP900	Mobrey
3B2F	MRL700	Mobrey
3B30	MRL800	Mobrey
3B31	MRL850	Mobrey
3C01	HPort	Arcom
3D01	L4610	Princo

Expanded Device Code (Hex)	Description	Company Name
3E01	LD301	Smar
3E02	TT301	Smar
3E03	FY301	Smar
3E04	LD291	Smar
3E05	TP301	Smar
3E06	DT301	Smar
3E09	TT400	Smar
3E0A	LD400	Smar
3F01	TSV175	Foxboro Eckardt
3F02	DMU130	Foxboro Eckardt
3F03	TI/RTT20	Foxboro Eckardt
3F04	SRD991	Foxboro Eckardt
3F05	DMU140	Foxboro Eckardt
3F06	SRD960	Foxboro Eckardt
4015	MTL4841 Multiplexer	Measurement Technology
4022	MTL8512 Multiplexer	Measurement Technology
42EE	373X-6	Samson
42EF	373X-3	Samson
42F9	3780	Samson
43EE	FM6XX	Sparling Instruments
45C8	OPTIBAR DP 70XX F	Krohne
45C9	OPTIBAR P 50/60XX F	Krohne
45CA	TFC 100	Krohne
45CB	IFC 050	Krohne
45CD	OPTISWIRL 4200	Krohne
45CE	OPTILEVEL 1100	Krohne
45CF	MAC100	Krohne
45D1	OPTIBAR P X050 C	Krohne
45D2	UFC 400	Krohne
45D3	TT51C/R	Krohne
45D4	GFC 300 Steam	Krohne
45D5	GFC 300 Gas	Krohne
45D6	ESK4	Krohne
45D9	IFC 100	Krohne
45DB	TT50C/R	Krohne
45DD	MFC 300	Krohne
45DE	VFC 070	Krohne
45E2	ESK2A	Krohne
45E3	IFC 300	Krohne
45E4	Optiflex 1300C	Krohne
45E5	Optiwave 7300C	Krohne
45E6	M8E	Krohne
45E7	UFC030	Krohne

Expanded Device Code (Hex)	Description	Company Name
45E8	MFC05x	Krohne
45E9	IFC040	Krohne
45EA	M10	Krohne
45EB	IFC210	Krohne
45EC	BM102	Krohne
45ED	VFM31	Krohne
45EE	BM100	Krohne
45EF	IFC020	Krohne
45F0	VFM1091	Krohne
45F2	ESKII	Krohne
45F3	IFC110	Krohne
45F4	IFC090	Krohne
45F5	UFC500	Krohne
45F6	IFC010	Krohne
45F7	MFC08x	Krohne
45F8	IFC080	Krohne
45F9	BM70	Krohne
47E9	RTX1000H Gauge	Druck
47EC	RTX1000H SG	Druck
47EF	RTX1000H ABS	Druck
49EB	AO895	Elcon Instruments
49EC	I895	Elcon Instruments
49ED	Mux 2700-F	Elcon Instruments
49EE	Mux 2700-E	Elcon Instruments
4D01	ICOT	Westlock Controls
4D02	SmartCal	Westlock Controls
4D03	D-EPIC	Westlock Controls
4D04	D-EPIC ESD	Westlock Controls
4E02	UNIVERSAL III	Drexelbrook
4EEB	USonic	Drexelbrook
4FED	5600	Rosemount Tank Radar
4FEF	TankRadarPro	Rosemount Tank Radar
5067	SPM100 Level	K-TEK
5072	AT100/200 Lvl Vol LCD	K-TEK
5073	AT100/200 2Lvl Vol LCD	K-TEK
5076	AT100/200 Lvl Temp Vol LCD	K-TEK
5077	AT100/200 2Lvl Temp Vol LCD	K-TEK
5078	AT100/200 Lvl	K-TEK
507A	AT100/200 Lvl LCD	K-TEK
507B	AT100/200 2Lvl LCD	K-TEK
507E	AT100/200 Lvl Temp LCD	K-TEK
507F	AT100/200 2Lvl Temp LCD	K-TEK
5098	MT2000 Microwave Level	K-TEK

Expanded Device Code (Hex)	Description	Company Name
50AA	MT5000	K-TEK
50AB	MT5100	K-TEK
50BA	MT5200	K-TEK
50C2	SS140XP	K-TEK
50CB	SPM200 Level	K-TEK
52E9	PIR 7000	Draeger
52EB	Polytron 7000	Draeger
52ED	Polytron2 IR	Draeger
52F7	Polytron2	Draeger
54F8	MSP2002	Siemens Milltronics PI
54F9	MST9500	Siemens Milltronics PI
55DE	HCM-8000	BTG
56E0	Model 706	Magnetrol
56E1	Model TA2 2.x	Magnetrol
56E2	Model R82	Magnetrol
56E3	E3 Modulevel	Magnetrol
56E4	Model 355	Magnetrol
56E5	Model 705 3.x	Magnetrol
56E6	Model RX5	Magnetrol
56E7	Model 704	Magnetrol
56E8	Jupiter	Magnetrol
56E9	Model TA2	Magnetrol
56EA	Model 707	Magnetrol
56EB	Model 705 2.x	Magnetrol
56EC	Model 708	Magnetrol
56ED	Model 805	Magnetrol
56EE	Model 705	Magnetrol
56EF	SMARTEZ	Magnetrol
57D5	SG9000H	Metso Automation
57D9	VG9000H	Metso Automation
57E4	ND9100HT	Metso Automation
57E5	ND9100H	Metso Automation
57EB	ValvGuard	Metso Automation
57EE	ND820/T	Metso Automation
57EF	ND820	Metso Automation
58C8	86x PROBE	Siemens Milltronics PI
58C9	SITRANS LR300	Siemens Milltronics PI
58CA	LR 200	Siemens Milltronics PI
58CC	SITRANS LR400	Siemens Milltronics PI
58CD	Sitrans Probe LU 6m	Siemens Milltronics PI
58CE	Sitrans Probe LU 12m	Siemens Milltronics PI
58CF	Probe LR	Siemens Milltronics PI
58D1	SITRANS LR250	Siemens Milltronics PI

Expanded Device Code (Hex)	Description	Company Name
58D3	SITRANS LR460	Siemens Milltronics PI
58D4	SITRANS LR260	Siemens Milltronics PI
58D6	SITRANS LR200	Siemens Milltronics PI
58D8	SITRANS AW200	Siemens Milltronics PI
5AC8	ANDRSN1	Anderson Instrument Company
5BEB	IPAQ C520/R520 (X)	Inor
5BEF	MESO	Inor
5CC8	Excalibur 7000	Robertshaw
5DDF	Pulscon LTC 5 x	Pepperl Fuchs
5DE0	P+F WHA-GW	Pepperl Fuchs
5DE1	P+F WHA-ADP	Pepperl Fuchs
5DE2	P+F WHA-UT	Pepperl Fuchs
5DE3	P+F WHA-RPT	Pepperl Fuchs
5DE4	CorrTran	Pepperl Fuchs
5DE5	LUC M	Pepperl Fuchs
5DE6	MUX2700-G	Pepperl Fuchs
5DE7	RSD-UO-Ex8.H	Pepperl Fuchs
5DE8	RSD-CI-Ex8.H	Pepperl Fuchs
5DE9	KSD2-GW2-PRO	Pepperl Fuchs
5DEA	BARCON M	Pepperl Fuchs
5DEB	LUC+	Pepperl Fuchs
5DEC	PULSCON+	Pepperl Fuchs
5DED	PULSCON	Pepperl Fuchs
5DEE	BARCON	Pepperl Fuchs
5DEF	KFD2-HMM-16	Pepperl Fuchs
5EEE	PRESS/DP XMTR	Accutech
5EEF	AI1500	Accutech
6007	BIFFI	700 Bridge
60ED	FLEXBAR 3501	Bourdon-Haenni
60EE	FLEXBAR HRT	Bourdon-Haenni
60EF	FLEXTOP HRT	Bourdon-Haenni
61E0	A411-CONDI	Knick
61E1	A411-COND	Knick
61E2	A411-OXY	Knick
61E3	A411-PH	Knick
61E4	Stratos Pro CondI	Knick
61E5	Stratos Pro Cond	Knick
61E6	Stratos Pro OXY	Knick
61E7	Stratos Pro pH	Knick
61E8	2211 CondI	Knick
61E9	2211 Oxy	Knick
61EA	2211 Cond	Knick
61EB	2211 pH	Knick

Expanded Device Code (Hex)	Description	Company Name
62C4	POINTRAC 31 SIL	VEGA
62C5	POINTRAC 31	VEGA
62C6	VEGAPULS SR 68	VEGA
62C7	VEGAPULS WL 61	VEGA
62C8	FIBERTRAC 31	VEGA
62C9	FIBERTRAC 32	VEGA
62CA	SOLITRAC 31	VEGA
62CB	MINITRAC 31	VEGA
62CC	MINITRAC 32	VEGA
62CD	MINITRAC 33	VEGA
62CE	WEIGHTRAC 31	VEGA
62CF	WEIGHTRAC 32	VEGA
62D0	MINITRAC 33 SIL	VEGA
62D1	MINITRAC 32 SIL	VEGA
62D2	MINITRAC 31 SIL	VEGA
62D3	SOLITRAC 31	VEGA
62D4	VEGAFLEX 80 series SIL	VEGA
62D5	VEGAFLEX 80 series	VEGA
62D6	VEGAPULS 68	VEGA
62D7	VEGAPULS 67	VEGA
62D8	VEGAPULS 66	VEGA
62D9	VEGAPULS 65	VEGA
62DA	VEGAPULS 63	VEGA
62DB	VEGAPULS 62	VEGA
62DC	VEGAPULS 61	VEGA
62DE	FIBERTRAC 32 SIL	VEGA
62DF	FIBERTRAC 31 SIL	VEGA
62E1	VEGADIF 65	VEGA
62E2	VEGABAR 5x/6x	VEGA
63ED	M-Series	MTS Systems Corp.
6464	ULTRAOVAL	Oval
6465	ExDelta	Oval
646E	9401 Mass flo	Oval
646F	9801 Mass flo	Oval
6470	9201 Mass flo	Oval
647B	9431 Mass flo	Oval
6564	HDLT	Masoneilan-Dresser
6565	12400 DLT	Masoneilan-Dresser
65C8	SVI	Masoneilan-Dresser
65C9	SVI2	Masoneilan-Dresser
65CA	SVI II AP	Masoneilan-Dresser
65CB	SVI II ESD	Masoneilan-Dresser
65CD	VECTOR	Masoneilan-Dresser

Expanded Device Code (Hex)	Description	Company Name
65CE	SVI II AP /H6	Masoneilan-Dresser
65CF	SVI II ESD /H6	Masoneilan-Dresser
66EF	CLS 4-20	Besta
67E0	DSTH/LSTH	Ohmart
67E1	DSTH/LSTH Comp	Ohmart
6801	ESR-D	Harold Beck and Sons
680A	BECK-DCM	Harold Beck and Sons
68EF	BECK-MK2	Harold Beck and Son
6BEB	DPT	Wika
6BEC	IPT	Wika
6BEE	UniTrans	Wika
6BEF	T32	Wika
6CEB	UMC2	Bopp & Reuther Heinrichs
6CEC	ES	Bopp & Reuther Heinrichs
6CED	VTX	Bopp & Reuther Heinrichs
6CEE	DIMF	Bopp & Reuther Heinrichs
6CEF	UST 1	Bopp & Reuther Heinrichs
6DDF	T55	PR Electronics
6DEA	PR 6337	PR Electronics
6DEB	PR 5337	PR Electronics
6DEE	Pretrans 6335	PR Electronics
6DEF	Pretop 5335	PR Electronics
6EDD	Actuator	Jordan Controls
71EE	MT115	Apparatebau Hundsbach
72DE	SPX	Dynisco
72DF	IPXII	Dynisco
72E0	IPX	Dynisco
74EF	DMC R-1A	Direct Measurement
75EF	Klay 2000 Pressure/Level	Klay
78EF	8630	Buerkert Fluid Control Systems
79EF	FORCEmeter	Venture Measurement
7CEE	M33-53P	GLI
7CEF	M33-53C	GLI
7EE0	SMT-EL	Paper Machine Components
7F3C	PASCAL CI	Labom
7FE0	IPX	Labom
7FEF	Pascal CV	Labom
8003	MAGFLO	Danfoss
817F	Intermag-Transmag	Turbo
8261	FST4000	Tokyo Keiso
8262	UME1000	Tokyo Keiso
8263	AM/T	Tokyo Keiso
8265	AM/H	Tokyo Keiso

Expanded Device Code (Hex)	Description	Company Name
8267	VFC 070	Tokyo Keiso
827B	FW-9000	Tokyo Keiso
827F	FST-3000	Tokyo Keiso
837D	IP8001	SMC
837E	IP8101	SMC
83EF	F793-E701	SMC
84EF	SEM 300	Status Instruments
857F	HK TT01	Huakong
8661	APT3200	Duon System
8667	APT3700N	Duon System
866B	APT3100	Duon System
8675	ATT2100S	Duon System
8701	Innova-Mass	Vortek Instruments, LLC
89EF	T798	Action Instruments
8C88	LTM-100	Magtech
8C89	LTM-300	Magtech
8C8A	LTM-350	Magtech
8D01	S95 HRT	Rueger
8D7F	S95.3U_2	Rueger
8E74	M420 Cond Ind	Mettler Toledo
8E75	M420 Cond	Mettler Toledo
8E76	M420 O2	Mettler Toledo
8E77	M420 pH	Mettler Toledo
8E78	CondI7100	Mettler Toledo
8E79	O2 4100e	Mettler Toledo
8E7A	Cond7100	Mettler Toledo
8E7B	Ph 2100	Mettler Toledo
8E7C	M400	Mettler Toledo
8E7D	M100	Mettler Toledo
8F76	X2200	Det-Tronics
8F77	X5200	Det-Tronics
8F78	X9800	Det-Tronics
8F79	X3302	Det-Tronics
8F7A	UD10	Det-Tronics
8F7B	GT3000	Det-Tronics
8F7C	X3301	Det-Tronics
8F7E	OPECL_RX	Det-Tronics
8F7F	Eclipse	Det-Tronics
907D	NDMi	Thermo MeasureTech
907E	Accu-Wave	Thermo MeasureTech
907F	NCMi	Thermo MeasureTech
91EF	Positioner	Dezurik
927F	Analyzer	Phase Dynamics

Expanded Device Code (Hex)	Description	Company Name
937A	WT3600	Welltech
937B	WT3000	Welltech
937C	WT2000	Welltech
9977	METRAN-303PR	Metran
9979	METRAN-150	Metran
997B	METRAN-390	Metran
997C	METRAN-300PRM	Metran
997D	METRAN-49	Metran
997E	METRAN-280	Metran
997F	METRAN-100	Metran
9A7F	P Series	Milton Roy Co.
9BD3	D3	PMV
9C01	KMU-HLI	Turck
9D70	x868	Panametrics
9D77	XMT900	Panametrics
9E01	ICS MUX FBS	Stahl
9E02	ICS 1000	Stahl
9E03	VOS 200	Stahl
9E04	ICS modul 9148	Stahl
9E05	I.S. 1 Remote I/O	Stahl
9E06	IS pac 9192 16 ch	Stahl
9E07	IS pac 9192 32 ch	Stahl
9F7F	D12	Analytical Technology Inc.
A002	PIR 2000	FINT
A0ED	OXI5000	FINT
A17C	LB466	BERTHOLD
A17D	LB491	BERTHOLD
A17E	LB460	BERTHOLD
A17F	LB490	BERTHOLD
A2EF	SMARTCET 18C	InterCorr
A678	ST98	Fluid Components
A67F	ST100 Series	Fluid Components
A87F	M3500	Meriam Instrument
A92E	I/A Pressure	Invensys
A934	CFT50	Invensys
AB01	SmartCal	Tyco Valves & Controls
AD00	GasFlowMeter	J-Tec Associates
AD01	LiquidFlowMeter	J-Tec Associates
AE7A	T215	Tracerco
AE7B	T251	Tracerco
AE7E	PRI-160	Tracerco
AE7F	PRI-150	Tracerco
AE9F	Level Combination Unit	Tracerco

Expanded Device Code (Hex)	Description	Company Name
B001	MCR-TS-LP	Phoenix Contact
B002	MCR-HT-TS	Phoenix Contact
B003	MACX MCR-S-MUX 16 ch	Phoenix Contact
B004	MACX MCR-S-MUX 32 ch	Phoenix Contact
B010	RAD-WHG/WLAN-XD	Phoenix Contact
B011	RAD-WHA	Phoenix Contact
B27F	Model 32E	Amer. Level Instr.
B401	YT-2300	YTC
B402	YT-2400	YTC
B403	YT-2500	YTC
B404	YT-2600	YTC
B405	YT-2700	YTC
B407	YT-3400	YTC
B409	YT-3300	YTC
B57F	Series442	Pyromation Inc.
B580	Series642	Pyromation Inc
B67F	V-series	Satron Instruments
B77D	HRTIMVS2000	BIFFI
B77E	HRT2000v4	BIFFI
B97F	DMD 331-A	BD Sensors
BC7A	LI-24	APLISENS
BC7B	APC-2000ALW	APLISENS
BD01	Primo Advanced	Badger Meter
BD02	M2000	Badger Meter
BE7E	HIMax Safety System	HIMA
BE7F	H 6210 Safety Mux	HIMA
BF7C	MDL 400	GP:50
C0EF	GT400	Kongsberg Maritime
C101	C/G Asameter /H	ASA S.r.l.
C128	ASAMAG/H	ASA S.r.l.
C221	TE 52	Hengesbach
C374	LSIII Pressure	Lanlian Instruments
C401	I/O Module	Spectrum Controls
C580	KC/3	Kajaani Process Measurements
C581	KC/5	Kajaani Process Measurements
C680	TORRIX	FAFNIR
C780	FLOWSIC 600	SICK-MAIHAK
C781	FLOWSIC 100	SICK-MAIHAK
C782	FLOWSIC 30	SICK-MAIHAK
CA80	SP301	Spirax Sarco Plc
CA81	TEG10	Spirax Sarco Plc
CC80	CH420L	Tecfluid S.A.
CC81	CH420R	Tecfluid S.A.

Expanded Device Code (Hex)	Description	Company Name
CE80	EPP300	Roost
CF80	EP1000/SPS200	Koso
CF81	EP1001	Koso
D280	XNX	Honeywell Analytics
D281	Optima+	Honeywell Analytics
D380	PAD	HEINRICHS
D381	PAS	HEINRICHS
D382	PAD-F	HEINRICHS
D383	DVH/DVE	HEINRICHS
D480	PES	SIC
D482	HVP	SIC
D485	HVP1114	SIC
D486	FLOW MASTER	SIC
D580	SI792P	HACH LANGE
D581	SI792C	HACH LANGE
D582	SI792T	HACH LANGE
D583	SI792E	HACH LANGE
D584	SI792D	HACH LANGE
D586	sc200 pH/ORP Module	HACH LANGE
D587	LDO	HACH LANGE
D588	sc200 Contacting Conductivity Module	HACH LANGE
D589	sc200 Inductive Conductivity Module	HACH LANGE
D58A	sc200 DO Module	HACH LANGE
D58B	sc200 Ultrasonic Flow Module	HACH LANGE
D58C	Surface Scatter 7 Turbidimeter	HACH LANGE
D58D	sc200 4-20mA Analog Input Module	HACH LANGE
D58E	sc pH/ORP Differential	HACH LANGE
D58F	FP360sc	HACH LANGE
D590	TSSsc	HACH LANGE
D591	1720E Turbidimeter	HACH LANGE
DB80	SharpEye	Spectrex
DB81	SafEye	Spectrex
DF80	FL4000	General Monitors, Inc.
DF81	S4000CH	General Monitors, Inc.
DF82	S4000TH	General Monitors, Inc.
DF83	IR400	General Monitors, Inc.
DF84	IR4000	General Monitors, Inc.
DF85	S4100CH	General Monitors, Inc.
DF87	IR5500	General Monitors, Inc.
DF88	IR700	General Monitors, Inc.
DF89	TS4000H	General Monitors, Inc.
DF90	FL3100H/FL3101H	General Monitors, Inc.
DF95	Observer-H / UltraSonic EX-5	General Monitors, Inc.

Expanded Device Code (Hex)	Description	Company Name
E080	ESD3000	ExSaf
E081	Sensor Don	Etalon Rus
E082	SDT420	SEOJIN INSTECH
E083	RT-Ex15	TASI FLOW
E084	SS	Daehan Control
E085	3DlevelScanner M	AMP
E086	3DlevelScanner S	AMP
E087	3DlevelScanner L	AMP
E088	EX200H Positioner	ORANGE INST UK
E089	IS200H Positioner	ORANGE INST UK
E08A	R3x	BARTEC
E08B	Detcon HRT Bridge	Detcon
E08C	UltimaXL/XT	MSA
E08D	CMM-01 MASS FLOW	METROVAL
E08E	JLT-6000	JOGLER
E08F	SMARTRONIC MA	KSB
E090	CMS Standard	Richter CT
E091	Millennium II	NET SAFETY
E092	HIM1008	SECanada
E093	CXT	SUPCON
E094	CJT	SUPCON
E095	HBM – 165 H	DKK – TOA
E096	HBM – 167 H	DKK – TOA
E097	WBM – 165 H	DKK – TOA
E098	OBM – 165 H	DKK – TOA
E099	OBM – 167 H	DKK – TOA
E09A	MBM – 165 H	DKK – TOA
E09B	MBM – 167 H	DKK – TOA
E09C	Mark Series	Dwyer Instruments
E09D	TR	FineTek
E09E	Millennium 2 Basic	NET SAFETY
E09F	ULTIMAXEH	MSA
E0A1	HRT1	Hoffer Flow Controls
E0F1	Freq --> mA	Hoffer Flow Controls
E0A2	DN2510 SmartMesh	Dust Networks
E0A3	M2510 SmartMesh	Dust Networks
E0A4	PM2510 SmartMesh	Dust Networks
E0A5	VFM 4097	Forbes Marshall
E0A6	IFC 031	Forbes Marshall
E0A7	IFC 021	Forbes Marshall
E0A8	SMARTPro Cond 8967	Forbes Marshall
E0A9	SMARTPro Ph 8966	Forbes Marshall
E0AA	SMARTPro DO 8968	Forbes Marshall

Expanded Device Code (Hex)	Description	Company Name
E0AB	AM-2000	All Measures
E0AC	Wireless Adapter	MACTek
E0AD	CSI 9420	CSI
E0AE	KMS-2	TC Fluid Control
E0AF	MWT-3905	Rohrback Cosasco Systems
E0B0	UWT-1000	Rohrback Cosasco Systems
E0B1	CWT-9020	Rohrback Cosasco Systems
E0B2	A-1000 H	AirSprite
E0B3	NCS-PT105 II	Microcyber Inc.
E0B4	STF	SEOJIN INSTECH
E0B5	SMF	SEOJIN INSTECH
E0B6	TY-TDS-P	TIG
E0B7	TY-TRANS-F	TIG
E0B8	TY-TRANS-L	TIG
E0B9	TY-TRANS-PS	TIG
E0BA	TY-TRANS-A	TIG
E0BB	PMH	Ifm prover GmbH
E0BC	FlameGard	MSA
E0BD	FLUXUS	FLEXIM
E0BE	MRG-10A	TOCIMEC INC.
E0BF	MRF-10	TOCIMEC INC.
E0C0	ULTRAMATE 136-ULT	SBEM
E0C1	Flow Control System	SkoFlo Industries, Inc.
E0C2	Axiom	StoneL Corporation
E0C3	EUMAG	EUREKA FLOW
E0C4	BA47X/67X SERIES	BEKA Associates
E0C5	MTRT	EUREKA FLOW
E0C6	CAP-30xx	CAPSTAR AUTOMATION
E0C7	Nemesis 1000	Pulsar
E0C8	CVM-01	METROVAL
E0C9	TDM-01	METROVAL
E0CA	Elemer AIR-10H	Elemer
E0CB	Elemer AIR-20H	Elemer
E0CC	Elemer AIR-30H	Elemer
E0CD	Frankenstein	Soft Tech Group
E0CE	4310 Valve Monitor	TopWorx
E0CF	NCS-PT105II-SP	Microcyber Inc.
E0D0	NCS-TT105	Microcyber Inc.
E0D1	WIDEPLUS-BA	FUJIAN WIDEPLUS PRECISION INSTRUMENTS CO., LTD
E0D2	WIDEPLUS-A	FUJIAN WIDEPLUS PRECISION INSTRUMENTS CO., LTD
E0D3	OXITEC 5000	ENOTEC GmbH
E0D4	COMTEC 6000	ENOTEC GmbH

Expanded Device Code (Hex)	Description	Company Name
E0D5	IHP	Val Controls A/S
E0D6	IDP	Val Controls A/S
E0D7	MFT B-Series	Kurz Instruments
E0D8	MICROGUIDE 132-TDR	SBEM
E0D9	MICROMATE 138-PLR	SBEM
E0DB	SGH350	E-Senza Technologies
E0DC	IRmax	Crowcon
E0DD	IR-Display	Crowcon
E0DE	TiXo3	GEORGIN
E0DF	JB-MPHF Series	NET SAFETY
E0E0	Master-Touch	Eldridge Products
E0E1	DLT9000	DDTOP
E0E2	FFG-P Level Sensor	KSR Kuebler
E0E3	SWH 5700 Steam	Armstrong Intl
E0E4	RWH 5500 Relief	Armstrong Intl
E0E5	TWH 5100 Temp	Armstrong Intl
E0E6	N7	Hitachi High-Tech
E0E7	Elemer Sapphire-22	Elemer
E0E8	Elemer-100	Elemer
E0E9	A2 4-20mA HRT	AMFLOW
E0EA	F0-Series	Fluidwell
E0EB	4350 On/Off Valve Controller	TopWorx
E0EC	EST3051T	ExSaf
E0ED	EST3051S	ExSaf
E0EE	mag-flux M	Mecon
E0EF	Fox FT3	Fox Thermal Inst.
E0F0	Prototype Unit	EJMConsulting
E0F2	SafEye	MSA
E0F3	PrimaX	MSA
E0F4	L-Dens 427T	Anton Paar
E0F5	ULM-70	Dinel, s.r.o.
E0F6	PrimaX IR	MSA
E0F7	GD10	Simtronics ASA
E0F8	MWT-WE	Rohrback Cosasco
E0F9	SPIROSTER-07	INTEC
E180	FSCHCOM	Fire Sentry Corp.
E181	Magnetostrictive Lvl	FUTURE INSTRUMENT
E182	RF Level Transmitter	FUTURE INSTRUMENT
E183	Radar Lvl Transmitter	FUTURE INSTRUMENT
E184	EA10S	MOTOYAMA
E185	NCS-FT105	Microcyber Inc.
E186	NCS-LT105	Microcyber Inc.
E187	NCS-AT105	Microcyber Inc.

Expanded Device Code (Hex)	Description	Company Name
E188	NCS-MH105	Microcyber Inc.
E189	NCS-POS105	Microcyber Inc.
E18A	SMART Actuator	MORGAN KOREA
E18B	Warrior Sensor	AWIATECH
E18C	iScan2	Coen Company
E18D	TX200H	United Electric
E18E	MWT-QS	Rohrback Cosasco
E18F	ELMAG 151	SBEM
E190	FST-3000	Shanghai Sinoto Instrument Co., Ltd
E191	SF10E	SUPCON
E192	WD-H	Softing
E193	MWLM-PR26	MATSUSHIMA
E194	Position Xmitter	TopWorx
E195	SB350	E-Senza Technologies
E196	VCM-01	MSA
E197	PTC VR SENSOR	Westcontrol AS
E198	OLCT 200	Oldham
E199	Elemer IPM 0399/M0-H	Elemer
E19A	Elemer TPU 0304/M1-H	Elemer
E19B	Elemer TPU 0304/M2-H	Elemer
E19C	SGOES	ESP Safety
E19D	OperaFCS	WooriTG
E19E	TMS-HPS	trianglemicrosol
E19F	MFI 860 NivoMag	Nivo Controls Pvt Ltd
E1A0	VL10	Nivis LLC
E1A1	VS220	Nivis LLC
E1A2	CMWA 8800	SKF USA
E1A3	AT2000	HollySys
E1A4	RPW01	INTEC
E1A5	X-MATIK	INTEC
E1A6	XI	INTEC
E1A7	Level Sensor	FineTek
E1A8	Corrosion	Korosi Specindo
E1A9	DM-TV6 & DF-TV7	Simtronics ASA
E1AA	IT Series	Sierra Monitor
E1AB	SSS-903	ESP Safety
E1AC	EFTN	DDTOP
E1AD	DTU100	DDTOP
E1AE	MTL100	DDTOP
E1AF	DLC3010	DDTOP
E1B0	FLOW100	DDTOP
E1B1	HRM V1.00	Schneider Electric
E1B2	Wireless Interface	Emerson

Expanded Device Code (Hex)	Description	Company Name
E1B3	H COMM	GF Signet
E1B4	RT-30	TASI FLOW
E1B5	SD-1	RIKEN KEIKI
E1B6	ABM200-xxxRxCH	ABM Sensor Tech
E1B7	DPU100	DDTOP
E1B8	DLU100	DDTOP
E1B9	DFU100	DDTOP
E1BA	ELMAG200MR1	EEPL,PUNE,INDIA
E1BB	TICO Flow Meter	Thermal Inst. Co.
E1BC	HDA4000	HYDAC ELECTRONIC
E1BD	DAIX	GNEUSS
E1BE	PTC VR SENSOR (wireless)	Westcontrol AS
E1BF	EIM CAM06	Valve Automation
E1C0	CorrLog Wireless	Roxar
E1C1	EIM CAM206	Valve Automation
E1C2	EIM CAM06 H5	Valve Automation
E1C3	GTD2000	GASTRON CO.,LTD
E1C4	DO Arc Hx	HAMILTON Bonaduz
E1C5	dBI	Pulsar
E1C6	GIR-3000	GASTRON CO.,LTD
E1C7	isNet Line	ifak system
E1C8	LCAMP-1XX	Nobel Weighing Systems
E1C9	T80 Transmitter	ECD
E1CA	WH StarterKit FD	Softing
E1CB	Tia3	GEORGIN
E1CC	RF Cap. Level Switch	FUTURE INSTRUMENT
E1CD	Fork Level Switch	FUTURE INSTRUMENT
E1CE	SEC5000IREvolution	Sensor Electronics
E1CF	IHP24-A	Val Controls
F980	WirelessHART Network Manager	HCF
F981	WirelessHART Gateway	HCF
F982	Generic	HCF
F983	SDC625	HCF
F984	Analys	HCF

5.2 Table 2. Engineering Unit Codes

This table is included to maintain backward compatibility with HART Revision 5 and earlier. For HART 6 and later, please refer to the expansion tables (Tables 2.64 and later) below. Actual text display of these codes is host dependent.

The enumerations range from 1- 169 and 220 – 239

Temperature

Unit Code	Description	Note
32	Degrees Celsius	
33	Degrees Fahrenheit	
34	Degrees Rankine	
35	Kelvin	

Pressure

Unit Code	Description	Note
1	inches of water at 68 degrees F	
2	inches of mercury at 0 degrees C	
3	feet of water at 68 degrees F	
4	millimeters of water at 68 degrees F	
5	millimeters of mercury at 0 degrees C	
6	pounds per square inch	
7	bars	
8	millibars	
9	grams per square centimeter	
10	kilograms per square centimeter	
11	pascals	
12	kilopascals	
13	torr	
14	atmospheres	
145	inches of water at 60 degrees F	
237	megapascals	
238	inches of water at 4 degrees C	
239	millimeters of water at 4 degrees C	

Volumetric Flow

Unit Code	Description	Note
15	cubic feet per minute	
16	gallons per minute	
17	liters per minute	
18	imperial gallons per minute	
19	cubic meter per hour	
22	gallons per second	

Volumetric Flow

Unit Code	Description	Note
23	million gallons per day	
24	liters per second	
25	million liters per day	
26	cubic feet per second	
27	cubic feet per day	
28	cubic meters per second	
29	cubic meters per day	
30	imperial gallons per hour	
31	imperial gallons per day	
121	normal cubic meter per hour	MKS System
122	normal liter per hour	MKS System
123	standard cubic feet per minute	U.S. System
130	cubic feet per hour	
131	cubic meters per minute	
132	barrels per second	1 barrel equals 42 U.S. gallons
133	barrels per minute	1 barrel equals 42 U.S. gallons
134	barrels per hour	1 barrel equals 42 U.S. gallons
135	barrels per day	1 barrel equals 42 U.S. gallons
136	gallons per hour	
137	imperial gallons per second	
138	liters per hour	
235	gallons per day	

Velocity

Unit Code	Description	Note
20	feet per second	
21	meters per second	
114	inches per second	
115	inches per minute	
116	feet per minute	
120	meters per hour	

Volume

Unit Code	Description	Note
40	gallons	
41	liters	
42	imperial gallons	
43	cubic meters	
46	barrels	1 barrel equals 42 U.S. gallons
110	bushels	

Volume

Unit Code	Description	Note
111	cubic yards	
112	cubic feet	
113	cubic inches	
124	bbl liq	1 liquid barrel equals 31.5 U.S. gallons
166	normal cubic meter	MKS System
167	normal liter	MKS System
168	standard cubic feet	U.S. System
236	hectoliters	

Length

Unit Code	Description	Note
44	feet	
45	meters	
47	inches	
48	centimeters	
49	millimeters	

Time

Unit Code	Description	Note
50	minutes	
51	seconds	
52	hours	
53	days	

Mass

Unit Code	Description	Note
60	grams	
61	kilograms	
62	metric tons	
63	pounds	
64	short tons	
65	long tons	
125	ounce	

Mass Flow

Unit Code	Description	Note
70	grams per second	
71	grams per minute	
72	grams per hour	
73	kilograms per second	
74	kilograms per minute	
75	kilograms per hour	
76	kilograms per day	
77	metric tons per minute	
78	metric tons per hour	
79	metric tons per day	
80	pounds per second	
81	pounds per minute	
82	pounds per hour	
83	pounds per day	
84	short tons per minute	
85	short tons per hour	
86	short tons per day	
87	long tons per hour	
88	long tons per day	

Mass per Volume

Unit Code	Description	Note
90	specific gravity units	
91	grams per cubic centimeter	
92	kilograms per cubic meter	
93	pounds per gallon	
94	pounds per cubic foot	
95	grams per milliliter	
96	kilograms per liter	
97	grams per liter	
98	pounds per cubic inch	
99	short tons per cubic yard	
100	degrees twaddell	
102	degrees baume heavy	
103	degrees baume light	
104	degrees API	
146	micrograms per liter	
147	micrograms per cubic meter	

Viscosity

Unit Code	Description	Note
54	centistokes	
55	centipoise	

Electromagnetic Unit of Electric Potential

Unit Code	Description	Note
36	millivolts	
58	volts	

Electrostatic Unit of Current

Unit Code	Description	Note
39	milliamperes	

Electromagnetic Unit of Resistance

Unit Code	Description	Note
37	ohms	
163	kohms	

Energy (includes Work)

Unit Code	Description	Note
69	newton meter	
89	deka therm	
126	foot pound force	
128	kilo watt hour	
162	mega calorie	1 calorie = 4.184 Joules
164	mega joule	
165	british thermal unit	1Btu=0.2519958kcal Energy

Power

Unit Code	Description	Note
127	kilo watt	
129	horsepower	
140	mega calorie per hour	1 calorie = 4.184 Joules
141	mega joule per hour	
142	british thermal unit per hour	1Btu=0.2519958kcal Energy

Radial Velocity

Unit Code	Description	Note
117	degrees per second	
118	revolutions per second	
119	revolutions per minute	

Miscellaneous

Unit Code	Description	Note
38	hertz	
56	microsiemens	
57	percent	
59	pH	
66	milli siemens per centimeter	
67	micro siemens per centimeter	
68	newton	
101	degrees brix	
105	percent solids per weight	
106	percent solids per volume	
107	degrees balling	
108	proof per volume	
109	proof per mass	
139	parts per million	
143	degrees	
144	radian	
148	percent consistency	
149	volume percent	
150	percent steam quality	
151	feet in sixteenths[1]	
152	cubic feet per pound	
153	picofarads	
154	mililiters per liter	
155	microliters per liter	
156	dB: Decibel	
160	percent plato	
161	percent lower explosion level	
169	parts per billion	

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[1] There must be 6 digits to the left of the decimal point of the associated numeric value. The format of the most significant two of these digits indicate the number of 'feet'. The adjacent two lesser significant digits indicate the number of additional sixteenths (i.e., 16 sixteenths = 1 inch). If the numeric value is in the floating point format, any digits to the right of the decimal point are discarded by the host.

Generic

Unit Code	Description	Note
240-249	Enumeration may be used for manufacturer specific definitions	
250	Not Used	
251	None	
252	Unknown	
253	Special	

Tables 2.64 and above are the Engineering Unit Code Expansion tables. They include all the existing enumerations from Table 2 (1 - 169 and 220 – 239) along with the Unit Code Expansion areas of 170 – 219

5.2.64 Table 2.64 Temperature Unit Codes
This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note
32	Degrees Celsius	
33	Degrees Fahrenheit	
34	Degrees Rankine	
35	Kelvin	

5.2.65 Table 2.65 Pressure Unit Codes

This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note
1	inches of water at 68 degrees F	
2	inches of mercury at 0 degrees C	
3	feet of water at 68 degrees F	
4	millimeters of water at 68 degrees F	
5	millimeters of mercury at 0 degrees C	
6	pounds per square inch	
7	bars	
8	millibars	
9	grams per square centimeter	
10	kilograms per square centimeter	
11	pascals	
12	kilopascals	
13	torr	
14	atmospheres	
145	inches of water at 60 degrees F	
170	centimeters of water at 4 degrees C	
171	meters of water at 4 degrees C	
172	centimeters of mercury at 0 degrees C	
173	pounds per square foot	
174	hectoPascals	
175	pounds per square inch absolute	
176	kilograms per square meter	
177	feet water 4 degrees C	
178	feet water at 60 degrees F	
179	meters of mercury at 0 degrees C	
180	1E6 psi million pounds per square inch	1E6 psi = 6894757 kPa
237	megapascals	
238	inches of water at 4 degrees C	
239	millimeters of water at 4 degrees C	

5.2.66 Table 2.66 Volumetric Flow Unit Codes

This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note
15	cubic feet per minute	
16	gallons per minute	
17	liters per minute	
18	imperial gallons per minute	
19	cubic meter per hour	
22	gallons per second	
23	million gallons per day	
24	liters per second	
25	million liters per day	
26	cubic feet per second	
27	cubic feet per day	
28	cubic meters per second	
29	cubic meters per day	
30	imperial gallons per hour	
31	imperial gallons per day	
121	normal cubic meter per hour	MKS System
122	normal liter per hour	MKS System
123	standard cubic feet per minute	U.S. System
130	cubic feet per hour	
131	cubic meters per minute	
132	barrels per second	1 barrel equals 42 U.S. gallons
133	barrels per minute	1 barrel equals 42 U.S. gallons
134	barrels per hour	1 barrel equals 42 U.S. gallons
135	barrels per day	1 barrel equals 42 U.S. gallons
136	gallons per hour	
137	imperial gallons per second	
138	liters per hour	
170	beer barrels per second	1 beer barrel equals 31 U.S. gallons
171	beer barrels per minute	1 beer barrel equals 31 U.S. gallons
172	beer barrels per hour	1 beer barrel equals 31 U.S. gallons
173	beer barrels per day	1 beer barrel equals 31 U.S. gallons
174	normal liter per day	at 273.15 degrees Kelvin, 101.325 kilo pascals
175	normal liter per minute	at 273.15 degrees Kelvin, 101.325 kilo pascals
176	normal liter per second	at 273.15 degrees Kelvin, 101.325 kilo pascals
177	standard liter per day	at 20 degrees Celsius, 1 Atmosphere
178	standard liter per hour	at 20 degrees Celsius, 1 Atmosphere
179	standard liter per minute	at 20 degrees Celsius, 1 Atmosphere
180	standard liter per second	at 20 degrees Celsius, 1 Atmosphere
181	normal cubic meter per day	at 273.15 degrees Kelvin, 101.325 kilopascals

Unit Code	Description	Note
182	normal cubic meter per minute	at 273.15 degrees Kelvin, 101.325 kilopascals
183	normal cubic meter per second	at 273.15 degrees Kelvin, 101.325 kilopascals
184	standard cubic feet per day	at 32 degrees Fahrenheit, 1 Atmosphere
185	standard cubic feet per hour	at 32 degrees Fahrenheit, 1 Atmosphere
186	standard cubic feet per second	at 32 degrees Fahrenheit, 1 Atmosphere
187	standard cubic meter per day	at 20 degrees Celsius, 1 Atmosphere
188	standard cubic meter per hour	at 20 degrees Celsius, 1 Atmosphere
189	standard cubic meter per minute	at 20 degrees Celsius, 1 Atmosphere
190	standard cubic meter per second	at 20 degrees Celsius, 1 Atmosphere
235	gallons per day	

5.2.67 Table 2.67 Velocity Unit Code
This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note
20	feet per second	
21	meters per second	SI base unit
114	inches per second	
115	inches per minute	
116	feet per minute	
120	meters per hour	

5.2.68 Table 2.68 Volume Unit Code

This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note
40	gallons	
41	liters	cubic decimeters
42	imperial gallons	
43	cubic meters	
46	barrels	1 barrel equals 42 U.S. gallons
110	bushels	
111	cubic yards	
112	cubic feet	
113	cubic inches	
124	bbl liq	1 liquid barrel equals 31.5 U.S. gallons
166	normal cubic meter	at 273.15 Kelvin, 1 Atmosphere
167	normal liter	at 273.15 Kelvin, 1 Atmosphere
168	standard cubic feet	at 273.15 Kelvin, 1 Atmosphere
170	beer barrel	31 US gallons
171	standard liter	at 20 degrees Celsius, 1 Atmosphere
172	standard cubic meter	at 20 degrees Celsius, 1 Atmosphere
236	hectoliters	

5.2.69 Table 2.69 Length Unit Code

This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note
44	feet	
45	meters	
47	inches	
48	centimeters	
49	millimeters	
151	feet in sixteenths[2]	
170	µm micron	1 micron = 1.0E-06 meter
171	µin microinch	1 microinch = 2.54E-08 meter

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[2] There must be 6 digits to the left of the decimal point of the associated numeric value. The format of the most significant two of these digits indicate the number of 'feet'. The adjacent two lesser significant digits indicate the number of additional sixteenths (i.e., 16 sixteenths = 1 inch). If the numeric value is in the floating point format, any digits to the right of the decimal point are discarded by the host.

5.2.70 Table 2.70 Time Unit Code

This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note
50	minutes	
51	seconds	
52	hours	
53	days	
170	ms milliseconds	10^{-3} seconds
171	µs microseconds	10^{-6} seconds
172	ns nanoseconds	10^{-9} seconds

5.2.71 Table 2.71 Mass Unit Code

This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note
60	grams	
61	kilograms	
62	metric tons	
63	pounds	
64	short tons	
65	long tons	
125	ounce	

5.2.72 Table 2.72 Mass Flow Code

This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note
70	grams per second	
71	grams per minute	
72	grams per hour	
73	kilograms per second	
74	kilograms per minute	
75	kilograms per hour	
76	kilograms per day	
77	metric tons per minute	
78	metric tons per hour	
79	metric tons per day	
80	pounds per second	
81	pounds per minute	
82	pounds per hour	
83	pounds per day	
84	short tons per minute	

Unit

Code	Description	Note
85	short tons per hour	
86	short tons per day	
87	long tons per hour	
88	long tons per day	

5.2.73 Table 2.73 Mass per Volume Unit Code

This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit

Code	Description	Note
90	specific gravity units	
91	grams per cubic centimeter	
92	kilograms per cubic meter	
93	pounds per gallon	
94	pounds per cubic foot	
95	grams per milliliter	
96	kilograms per liter	
97	grams per liter	
98	pounds per cubic inch	
99	short tons per cubic yard	
100	degrees twaddell	
102	degrees baume heavy	
103	degrees baume light	
104	degrees API	
146	micrograms per liter	
147	micrograms per cubic meter	
148	percent consistency	
170	milligrams per liter	
	mg/m3 (milligrams per cubic meter)	milligrams per cubic meter. example: 0.0409 * ppm * molecular weight of gas = mg/m3

5.2.74 Table 2.74 Viscosity Unit Code
This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note
54	cSt centistokes	
55	cP centipoise	
170	Pa-s Pascal second	1 Pa-s = 1000 centipoise (cP)

5.2.75 Table 2.75 Angular Velocity Unit Code
This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note
117	degrees per second	
118	revolutions per second	
119	revolutions per minute	

5.2.76 Table 2.76 Area Unit Code
This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note

5.2.77 Table 2.77 Energy (Work) Unit Code
This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note
69	joule	newton meter
89	Dth deka therm MMBtu Million British thermal unit	1 MMBtu = 1055.056 megajoule (MJ)
126	foot pound force	1.3558179483314 joules
128	kilo watt hour	3.6 megajoules
162	mega calorie	1 calorie = 4.184 Joules
164	mega joule	
165	Btu british thermal unit	1Btu= 1055.056 Joules

5.2.78 Table 2.78 Force Unit Code
This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note
68	N Newton	
170	kN kilo Newton	1,000 Newton

5.2.79 Table 2.79 Power Unit Code
This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*. Base SI unit is Watt.

Unit Code	Description	Note
127	kilo watt	
129	horsepower	
140	mega calorie per hour	1 calorie = 4.184 Joules
141	mega joule per hour	
142	british thermal unit per hour	1Btu=0.2519958kcal Energy
170	MJ/s megajoules per second MW MegaWatt	
171	MJ/d megajoules per day	1 MJ/d = 1.15741E-05 MW
172	MMBtu/s million British thermal units per second	1 MMBtu/s = 1055.056 MW
173	MMBtu/h million British thermal units per hour	1 MMBtu/h = 0.2930711 MW
174	MMBtu/d million British thermal units per day	1 MMBtu/d = 0.0122113 MW

5.2.80 Table 2.80 Frequency Unit Code
This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note
38	hertz	

5.2.81 Table 2.81 Analytical Unit Code
This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note
57	percent	
59	pH	
150	percent steam quality	
160	percent plato	
161	percent lower explosion level	

5.2.82 Table 2.82 Capacitance Unit Code
This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note
153	picofarads	

5.2.83 Table 2.83 EMF Unit Code
This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note
36	millivolts	
58	volts	

5.2.84 Table 2.84 Current Unit Code
This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note
39	milliamperes	
170	nA: nanoamperes	
171	µA: microamperes	

5.2.85 Table 2.85 Resistance Unit Code
This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note
37	Ω ohms	
163	kΩ kilo ohms	
170	MΩ mega ohms	
171	Ohm cm	Ohm cm, kOhm cm, MOhm cm are volumetric resistance. They are resistivity units that cannot be directly converted to resistance.
172	kOhm cm	
173	MOhm cm	
174	mΩ milli Ohms	$10^{-3} \, \Omega$

5.2.86 Table 2.86 Angle Unit Code
This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note
143	degrees	
144	radian	

5.2.87 Table 2.87 Conductance Unit Code
This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note
56	microsiemens	
66	milli siemens per centimeter	milli and micro siemens per centimeter are volumetric conductance. They are conductivity units that cannot be directly converted to conductance.
67	micro siemens per centimeter	

5.2.88 Table 2.88 Volume per Volume Unit Code
This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note
149	volume percent	
154	mililiters per liter	
155	microliters per liter	

5.2.89 Table 2.89 Volume per Mass Unit Code
This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note
107	degrees balling	
152	cubic feet per pound	

5.2.90 Table 2.90 Concentration Unit Code

This is an Engineering Unit Code Expansion Table that may only be used by Field Devices compatible with Revision 6 or later of the *HART Field Communications Protocol Specification*.

Unit Code	Description	Note
57	Percent	
101	°Bx degrees brix	
105	percent solids per weight	
106	percent solids per volume	
108	proof per volume	
109	proof per mass	
139	ppm parts per million	
169	ppb parts per billion	
170	ppth parts per thousand	

5.2.96 Table 2.96 Acceleration Unit Code

Unit Code	Description	Note
170	g - Gravitational Acceleration	
171	feet per second squared	NIST typically uses terms like "square meter" when length is in play and "second squared" when time is in play.
172	meter per second squared	

5.2.97 Table 2.97 Turbidity Unit Codes

Turbidity is used to characterize clarity of water. A larger value indicates more particulates suspended in the water.

Unit Code	Description	Note
170	FNU: Formazin Nephelometric Units	ISO
171	FTU: Formazin Turbidity Unit	Water containing 1 milligram of microspheres of the polymer formazin.
172	NTU: Nephelometric Turbidity Unit	Water containing 1 milligram of finely divided silica per liter has a turbidity of 1 NTU

5.2.99 Table 2.99 Volumetric Gas Flow per Second

Unit Code	Description	Note
186	standard cubic feet per second	at 273.15 Kelvin, 1 Atmosphere
176	normal liter per second	at 273.15 Kelvin, 1 Atmosphere
180	standard liter per second	at 20 degrees Celsius, 1 Atmosphere
183	normal cubic meter per second	at 273.15 Kelvin, 1 Atmosphere
190	standard cubic meter per second	at 20 degrees Celsius, 1 Atmosphere

5.2.100 Table 2.100 Volumetric Gas Flow per Minute

Unit Code	Description	Note
123	standard cubic feet per minute	at 273.15 Kelvin, 1 Atmosphere
175	normal liter per minute	at 273.15 Kelvin, 1 Atmosphere
179	standard liter per minute	at 20 degrees Celsius, 1 Atmosphere
182	normal cubic meter per minute	at 273.15 Kelvin, 1 Atmosphere
189	standard cubic meter per minute	at 20 degrees Celsius, 1 Atmosphere

5.2.101 Table 2.101 Volumetric Gas Flow per Hour

Unit Code	Description	Note
185	standard cubic feet per hour	at 273.15 Kelvin, 1 Atmosphere
122	normal liter per hour	at 273.15 Kelvin, 1 Atmosphere
178	standard liter per hour	at 20 degrees Celsius, 1 Atmosphere
121	normal cubic meter per hour	at 273.15 Kelvin, 1 Atmosphere
188	standard cubic meter per hour	at 20 degrees Celsius, 1 Atmosphere

5.2.102 Table 2.102 Volumetric Gas Flow per Day

Unit Code	Description	Note
184	standard cubic feet per day	at 273.15 Kelvin, 1 Atmosphere
174	normal liter per day	at 273.15 Kelvin, 1 Atmosphere
177	standard liter per day	at 20 degrees Celsius, 1 Atmosphere
181	normal cubic meter per day	at 273.15 Kelvin, 1 Atmosphere
187	standard cubic meter per day	at 20 degrees Celsius, 1 Atmosphere

5.2.103 Table 2.103 Volumetric Liquid Flow per Second

Unit Code	Description	Note
174	Imperial Fluid ounces per second	28.4130625 mL
175	US Fluid ounces per second	29.5735295625 mL
176	milliliter (cc) per second	10^{-3} Liter
24	liters per second	
178	hectoliter per second	10^{2} Liter
28	cubic meter (kiloliter) per second	10^{3} Liter
180	million liters (megaliter) per second	10^{6} Liter
22	US gallons per second	3.785411784 Liter
182	US kilogallon per second	10^{3} US Gallon
183	US million gallons per second	10^{6} US Gallon
137	imperial gallons per second	4.54609 Liter
185	imperial million gallons per second	10^{6} Imperial Gallon
26	cubic feet per second	28.316846592 Liter
187	Acre-Feet per second	1,233,481.8553 Liter
188	US drum per second	55 US Gal
189	US liquid barrel per second	31 US Gal
170	US beer barrel per second	31.5 US Gal
132	Oil barrels per second	42 US Gal; 34.97 Imperial Gal
192	UK beer barrel per second	36 Imperial Gall

5.2.104 Table 2.104 Volumetric Liquid Flow per Minute

Unit Code	Description	Note
174	Imperial Fluid ounces per minute	28.4130625 mL
175	US Fluid ounces per minute	29.5735295625 mL
176	milliliter (cc) per minute	10^{-3} Liter
17	liters per minute	
178	hectoliter per minute	10^2 Liter
131	cubic meter (kiloliter) per minute	10^3 Liter
180	million liters (megaliter) per minute	10^6 Liter
16	US gallons per minute	3.785411784 Liter
182	US kilogallon per minute	10^3 US Gallon
183	US million gallons per minute	10^6 US Gallon
18	imperial gallons per minute	4.54609 Liter
185	imperial million gallons per minute	10^6 Imperial Gallon
15	cubic feet per minute	28.316846592 Liter
187	Acre-Feet per minute	1,233,481.8553 Liter
188	US drum per minute	55 US Gal
189	US liquid barrel per minute	31 US Gal
171	US beer barrel per minute	31.5 US Gal
133	Oil barrels per minute	42 US Gal; 34.97 Imperial Gal
192	UK beer barrel per minute	36 Imperial Gall

5.2.105 Table 2.105 Volumetric Liquid Flow per Hour

Unit Code	Description	Note
174	Imperial Fluid ounces per hour	28.4130625 mL
175	US Fluid ounces per hour	29.5735295625 mL
176	milliliter (cc) per hour	10^{-3} Liter
138	liters per hour	
178	hectoliter per hour	10^{2} Liter
29	cubic meter (kiloliter) per hour	10^{3} Liter
180	million liters (megaliter) per hour	10^{6} Liter
136	US gallons per hour	3.785411784 Liter
182	US kilogallon per hour	10^{3} US Gallon
183	US million gallons per hour	10^{6} US Gallon
30	imperial gallons per hour	4.54609 Liter
185	imperial million gallons per hour	10^{6} Imperial Gallon
130	cubic feet per hour	28.316846592 Liter
187	Acre-Feet per hour	1,233,481.8553 Liter
188	US drum per hour	55 US Gal
189	US liquid barrel per hour	31 US Gal
172	US beer barrel per hour	31.5 US Gal
134	Oil barrels per hour	42 US Gal; 34.97 Imperial Gal
192	UK beer barrel per hour	36 Imperial Gall

5.2.106 Table 2.106 Volumetric Liquid Flow per Day

Unit Code	Description	Note
174	Imperial Fluid ounces per day	28.4130625 mL
175	US Fluid ounces per day	29.5735295625 mL
176	milliliter (cc) per day	10^{-3} Liter
177	Liters per day	
178	Hectoliter per day	10^{2} Liter
19	cubic meter (kiloliter) per day	10^{3} Liter
25	million liters (megaliter) per day	10^{6} Liter
235	US gallons per day	3.785411784 Liter
182	US kilogallon per day	10^{3} US Gallon
23	US million gallons per day	10^{6} US Gallon
31	imperial gallons per day	4.54609 Liter
185	imperial million gallons per day	10^{6} Imperial Gallon
27	cubic feet per day	28.316846592 Liter
187	Acre-Feet per day	1,233,481.8553 Liter
188	US drum per day	55 US Gal
189	US liquid barrel per day	31 US Gal
173	US beer barrel per day	31.5 US Gal
135	Oil barrels per day	42 US Gal; 34.97 Imperial Gal
192	UK beer barrel per day	36 Imperial Gall

5.2.107 Table 2.107 Thermal Expansion Unit Codes

Unit Code	Description	Note
170	/C	
171	/F	/F = /C x 1.8

5.2.108 Table 2.108 Volumetric Energy Density Unit Codes

Unit Code	Description	Note
170	kJ/l kilojoules per liter	Base unit
171	Btu/ft3 British thermal units per cubic foot	1 Btu/ft3 = 0.03726 kJ/l

5.3 Table 3. Transfer Function Codes

Code	Transfer Function Description	Note
0	Linear	Equation $y=mx+b$
1	Square Root	Equation $y=sqrt(x)$
2	Square Root Third Power	Equation $y=sqrt(x^3)$
3	Square Root Fifth Power	Equation $y=sqrt(x^5)$
4	Special Curve	
5	Square	Equation $y=x^2$
230	Discrete (Switch)	Binary (on/off)
231	Square Root Plus Special Curve	Do Not Use - See Note 1
232	Square Root Third Power Plus Special Curve	Do Not Use - See Note 1
233	Square Root Fifth Power Plus Special Curve	Do Not Use - See Note 1
240-249	Enumeration May Be Used For Manufacturer Specific Definitions	
250	Not Used	
251	None	
252	Unknown	
253	Special	

Note: Codes 231-233 are only listed in the Table for backward compatibility. These Codes should not be used in new devices. Since these codes allow the use of a "special curve", their meaning is not consistent when used in different devices.

5.4 Table 4. Material Codes

The materials in this table should be solids at 72 Degrees Fahrenheit

Material Code	Description	Notes	Material Code	Description	Notes
0	Carbon Steel		24	Kynar	4
1	Stainless Steel 304		25	Aluminium	
2	Stainless Steel 316		26	Nickel	
3	Hastelloy C		27	Fep	5
4	Monel		28	Stainless Steel 316 Ti	
5	Tantalum		30	Hastelloy C276	
6	Titanium		31	Klinger C4401	
7	Pt Ir		32	Thermotork	
8	Alloy 20		33	Grafoil	
9	Co Cr Ni		34	Ptfe Coated 316l Sst	
10	Ptfe		35	Gold Plated Hastelloy C276	
11	Vito		36	Ptfe Glass	
12	Buna N		37	Ptfe Graphite	
13	Ethyl Prop		38	Aflas	
14	Urethane		234	PTFE Hastelloy	
15	Gold Monel		235	Stainless Steel CF 8M	
16	Tefzel		236	Hastelloy Nitrile Sst	
17	Ryton	1	237	Gold Plated Sst	
18	Ceramic		239	Monel 400	
19	Stainless Steel 316L		240-249	Enumeration May Be Used For Manufacturer Specific Definitions	
20	Pvc		250	Not Used	
21	Nitrile Rubber		251	None	
22	Kalrez	2	252	Unknown	
23	Inconel	3	253	Special	

<u>Notes</u>

1. Ryton is a registered trademark of Phillips Petroleum Company.

2. Teflon and Kalrez are registered trademarks of E. I. DuPont De Nemours Company.

3. Inconel is a trademark of International Nickel Company.

4. Kynar is a trademark of Pennwalt Incorporated. Hastelloy C is a trademark of Cabot Corporation.

5. Typically a sealing material for O-Ring

5.5 Table 5. NULL

Code   Description

      This Table is Reserved

5.6   Table 6. Alarm Selection Codes

These apply to the alarm state of the physical output of an Analog Output

Code	Alarm Selection Description
0	High
1	Low
239	Hold Last Output Value
240-249	Enumeration May Be Used For Manufacturer Specific Definitions
250	Not Used
251	None
252	Unknown
253	Special

5.7   Table 7. Write Protect Codes

Code	Write Protect Description
0	No - Not Write Protected
1	Yes - Write Protected
250	Not Used
251	None
252	Unknown
253	Special

5.8   Table 8. Manufacturer Identification Codes

Any enumerations in the range from 250-255 are 'Reserved' and must not be used by any Field Device.

Code Dec.	Hex	Company Name	Code Dec.	Hex	Company Name
1	0001	Acromag	42	002A	Siemens
2	0002	Allen Bradley	43	002B	Weed
3	0003	Ametek	44	002C	Toshiba
4	0004	Analog Devices	45	002D	Transmation
5	0005	ABB	46	002E	Rosemount Analytic
6	0006	Beckman	47	002F	Metso Automation
7	0007	Bell Microsensor	48	0030	Flowserve
8	0008	Bourns	49	0031	Varec
9	0009	Bristol Babcock	50	0032	Viatran
10	000A	Brooks Instrument	51	0033	Delta/Weed
11	000B	Chessell	52	0034	Westinghouse
12	000C	Combustion Engineering	53	0035	Xomox
13	000D	Daniel Industries	54	0036	Azbil
14	000E	Delta	55	0037	Yokogawa
15	000F	Dieterich Standard	56	0038	Nuovo Pignone
16	0010	Dohrmann	57	0039	Promac
17	0011	Endress & Hauser	58	003A	Exac Corporation
18	0012	ABB	59	003B	Mobrey
19	0013	Fisher Controls	60	003C	Arcom Control System
20	0014	Foxboro	61	003D	Princo
21	0015	Fuji	62	003E	Smar
22	0016	ABB	63	003F	Foxboro Eckardt
23	0017	Honeywell	64	0040	Measurement Technology
24	0018	ITT Barton	65	0041	Applied System Technologies
25	0019	Thermo MeasureTech	66	0042	Samson
26	001A	ABB	67	0043	Sparling Instruments
27	001B	Leeds & Northrup	68	0044	Fireye
28	001C	Leslie	69	0045	Krohne
29	001D	M-System Co.	70	0046	Betz
30	001E	Measurex	71	0047	Druck
31	001F	Micro Motion	72	0048	SOR
32	0020	Moore Industries	73	0049	Elcon Instruments
33	0021	PRIME Measurement Products	74	004A	EMCO
34	0022	Ohkura Electric	75	004B	Termiflex Corporation
35	0023	Paine	76	004C	VAF Instruments
36	0024	Rochester Instrument Systems	77	004D	Westlock Controls
37	0025	Ronan	78	004E	Drexelbrook
38	0026	Rosemount	79	004F	Rosemount Tank Radar
39	0027	Peek Measurement	80	0050	K-TEK
40	0028	Actaris Neptune	81	0051	SENSIDYNE, INC
41	0029	Sensall	82	0052	Draeger

Code		Company Name	Code		Company Name
Dec.	Hex		Dec.	Hex	
83	0053	Raytek	125	007D	Fisher-Rosemount Performance Technologies
84	0054	Siemens Milltronics PI	126	007E	Paper Machine Components
85	0055	BTG	127	007F	LABOM
86	0056	Magnetrol	128	0080	Danfoss
87	0057	Metso Automation	129	0081	Turbo
88	0058	Siemens Milltronics PI	130	0082	TOKYO KEISO
89	0059	HELIOS	131	0083	SMC
90	005A	Anderson Instrument Company	132	0084	Status Instruments
91	005B	INOR	133	0085	Huakong
92	005C	ROBERTSHAW	134	0086	Duon System
93	005D	PEPPERL+FUCHS	135	0087	Vortek Instruments, LLC
94	005E	ACCUTECH	136	0088	AG Crosby
95	005F	Flow Measurement	137	0089	Action Instruments
96	0060	Bourdon-Haenni	138	008A	Keystone Controls
97	0061	Knick	139	008B	Thermo Electric Co.
98	0062	VEGA	140	008C	ISE Magtek
99	0063	MTS Systems Corp.	141	008D	Rueger
100	0064	Oval	142	008E	Mettler Toledo
101	0065	Masoneilan-Dresser	143	008F	Det-Tronics
102	0066	BESTA	144	0090	Thermo MeasureTech
103	0067	Ohmart	145	0091	DeZURIK
104	0068	Harold Beck and Sons	146	0092	Phase Dynamics
105	0069	rittmeyer instrumentation	147	0093	WELLTECH SHANGHAI
106	006A	Rossel Messtechnik	148	0094	ENRAF
107	006B	WIKA	149	0095	4tech ASA
108	006C	Bopp & Reuther Messtechnik	150	0096	Brandt Instruments
109	006D	PR Electronics	151	0097	Nivelco
110	006E	Jordan Controls	152	0098	Camille Bauer
111	006F	Valcom s.r.l.	153	0099	Metran
112	0070	US ELECTRIC MOTORS	154	009A	Milton Roy Co.
113	0071	Apparatebau Hundsbach	155	009B	PMV
114	0072	Dynisco	156	009C	Turck
115	0073	Spriano	157	009D	Panametrics
116	0074	Direct Measurement	158	009E	R. Stahl
117	0075	Klay Instruments	159	009F	Analytical Technology Inc.
118	0076	CiDRA CORP.	160	00A0	FINT
119	0077	MMG AM DTR	161	00A1	BERTHOLD
120	0078	Buerkert Fluid Control Systems	162	00A2	InterCorr
121	0079	Venture Measurement	163	00A3	China BRICONTE Co Ltd
122	007A	PONDUS INSTRUMENTS	164	00A4	Electron Machine
123	007B	ZAP S.A. Ostrow Wielkopolski	165	00A5	Sierra Instruments
124	007C	GLI	166	00A6	Fluid Components Intl

Code Dec.	Hex	Company Name	Code Dec.	Hex	Company Name
167	00A7	Solid AT	210	00D2	Honeywell Analytics
168	00A8	Meriam Instrument	211	00D3	HEINRICHS
169	00A9	Invensys	212	00D4	SIC
170	00AA	S-Products	213	00D5	HACH LANGE
171	00AB	Tyco Valves & Controls	214	00D6	Exalon Instruments
172	00AC	Micro Matic Instrument A/S	215	00D7	FAURE HERMAN
173	00AD	J-Tec Associates	216	00D8	STI S.r.l.
174	00AE	TRACERCO	217	00D9	Manometr-Kharkiv
175	00AF	AGAR	218	00DA	Dalian-Instruments
176	00B0	Phoenix Contact	219	00DB	Spectrex
177	00B1	Andean Instruments	220	00DC	SIPAI Instruments
178	00B2	Amer. Level Instr.	221	00DD	Advanced Flow
179	00B3	Hawk	222	00DE	Rexa. Koso America
180	00B4	YTC	223	00DF	General Monitors, Inc.
181	00B5	Pyromation Inc.	224	00E0	Manufacturer Expansion
182	00B6	Satron Instruments	225	00E1	Manufacturer Expansion
183	00B7	BIFFI	249	00F9	HART Communication Foundation
184	00B8	Shanghai Automation Instrumentation	24576	6000	ExSaf
185	00B9	BD Sensors	24577	6001	SEOJIN INSTECH
186	00BA	Andean Instruments	24578	6002	TASI FLOW
187	00BB	Kemotron	24579	6003	Daehan Control
188	00BC	APLISENS	24580	6004	APM
189	00BD	Badger Meter	24581	6005	ORANGE INST. UK
190	00BE	HIMA	24582	6006	BARTEC
191	00BF	GP:50	24583	6007	Detcon
192	00C0	Kongsberg Maritime	24584	6008	MSA
193	00C1	ASA S.p.A.	24585	6009	METROVAL
194	00C2	Hengesbach	24586	600A	Etalon Rus
195	00C3	Lanlian Instruments	24587	600B	JOGLER
196	00C4	Spectrum Controls	24588	600C	KSB
197	00C5	Kajaani Process Measurements	24589	600D	Richter CT
198	00C6	FAFNIR	24590	600E	NET SAFETY
199	00C7	SICK-MAIHAK	24591	600F	SECanada
200	00C8	JSP Nova Paka	24592	6010	SUPCON
201	00C9	MESACON	24593	6011	DKK - TOA
202	00CA	Spirax Sarco Plc	24594	6012	Dwyer Instruments
203	00CB	L&J TECHNOLOGIES	24595	6013	FineTek
204	00CC	Tecfluid S.A.	24596	6014	TopWorx Inc.
205	00CD	Sailsors Instruments	24597	6015	HOFFER FLOW CNTRLS
206	00CE	Roost	24598	6016	DUST NETWORKS
207	00CF	KOSO	24599	6017	Forbes Marshall
208	00D0	MJK	24600	6018	All Measures, Ltd.
209	00D1	GE Energy	24601	6019	MACTek

Code Dec.	Hex	Company Name	Code Dec.	Hex	Company Name
24602	601A	CSI	24642	6042	Fire Sentry Corp
24603	601B	TC Fluid Control	24643	6043	FUTURE INSTRUMENT
24604	601C	Rohrback Cosasco	24644	6044	MOTOYAMA
24605	601D	AirSprite	24645	6045	ifak system
24606	601E	Microcyber Inc.	24646	6046	MORGAN KOREA
24607	601F	TIG	24647	6047	AWIATECH
24608	6020	ifm prover Gmbh	24648	6048	Coen Company
24609	6021	FLEXIM	24649	6049	United Electric
24610	6022	TOKIMEC.INC	24650	604A	Shanghai Sinoto Instrument Co., Ltd
24611	6023	SBEM	24651	604B	MATSUSHIMA
24612	6024	SkoFlo Industries, Inc.	24652	604C	Westcontrol AS
24613	6025	StoneL Corporation	24653	604D	Oldham
24614	6026	EUREKA FLOW	24654	604E	WooriTG
24615	6027	BEKA associates	24655	604F	trianglemicrosol
24616	6028	CAPSTAR AUTOMATION	24656	6050	Nivo Controls Pvt Ltd
24617	6029	Pulsar	24657	6051	Nivis LLC
24618	602A	Elemer	24658	6052	SKF USA
24619	602B	Soft Tech Group	24659	6053	ESP Safety
24620	602C	FUJIAN WIDEPLUS PRECISION INSTRUMENTS CO., LTD	24660	6054	HollySys
			24661	6055	GF Signet
24621	602D	ENOTEC GmbH	24662	6056	Korosi Specindo
24622	602E	Val Controls A/S	24663	6057	Sierra Monitor
24623	602F	Kurz Instruments	24664	6058	Schneider Electric
24624	6030	E-Senza Technologies	24665	6059	Emerson
24625	6031	Crowcon	24666	605A	ABM Sensor Tech
24626	6032	GEORGIN	24667	605B	RIKEN KEIKI
24627	6033	Eldridg Products	24668	605C	EEPL,PUNE,INDIA
24628	6034	DDTOP	24669	605D	Thermal Inst. Co.
24629	6035	KSR Kuebler	24670	605E	HYDAC ELECTRONIC
24630	6036	Armstrong Intl	24671	605F	GNEUSS
24631	6037	Hitachi High-Tech	24672	6060	Valve Automation
24632	6038	AMFLOW	24673	6061	Roxar
24633	6039	Fluidwell	24674	6062	GASTRON CO.,LTD
24634	603A	Mecon	24675	6063	HAMILTON Bonaduz
24635	603B	Fox Thermal Inst.	24676	6064	Nobel Weighing Systems
24636	603C	EJMConsulting	24677	6065	ECD
24637	603D	Anton Paar	24678	6066	Sensor Electronics
24638	603E	Dinel, s.r.o.			
24639	603F	Simtronics ASA			
24640	6040	INTEC			
24641	6041	Softing			

5.9   Table 9. Burst Mode Control Codes

Code   Burst Mode Control Definition

0   Off

1   Enable Burst on Token-Passing Data Link Layer only

2   Enable Burst on TDMA Data-Link Layer only

3   Enable Burst on TDMA and Token Passing Data Link Layers

250   Reserved

251   Reserved

252   Reserved

253   Reserved

5.10 Table 10. Physical Signaling Codes

Enumeration 7 is 'Reserved', potentially for an expansion indication.

Any enumerations in the range from 8-255 are not allowed.

Code   Physical Signal Definition

0   Bell 202 Current

1   Bell 202 Voltage

2   RS-485

3   RS-232

4   Wireless

6   Special (includes, for example, Ethernet, TCP/IP, WiFi, etc.)

5.11 Table 11. Flag Assignments

Any bit not covered is 'Undefined' and must be set to zero.

Code   Flag Assignment Definition

0x01   Multi-Sensor Field Device

0x02   EEPROM Control

0x04   Protocol Bridge Device

0x08   IEEE 802.15.4 2.4GHz DSSS with O-QPSK Modulation

0x40   C8PSK Capable Field Device

0x80   C8PSK In Multi-Drop Only

5.12 Table 12. Transfer Service Function Codes
See Block Data Transfer Specification (HCF_SPEC-190)

5.13 Table 13. Transfer Service Identifier Codes
See Block Data Transfer Specification (HCF_SPEC-190)

5.14 Table 14. Operating Mode Codes
This table is reserved and all devices must return 0 for this byte in Command 48 Read Additional Status.

Code	Operating Mode Description
	This Table is Reserved. All devices using Table 14 must return 0x00 for Operating Mode

5.15 Table 15. Analog Channel Number Codes

Code	Analog Channel Number Description
0	Analog Channel 0 (PV)
1	Analog Channel 1 (SV)
2	Analog Channel 2 (TV)
3	Analog Channel 3 (QV)
4	Analog Channel 4

5.16 Table 16. Loop Current Mode Codes
These codes apply to the loop current signaling state of the device.

Code	Loop Current Mode Description
0	Disabled
1	Enabled

5.17 Table 17. Extended Device Status Codes

Any bit not specified is 'Undefined' and must be set to zero.

5.17.1   Application of Status bits to NAMUR NE107 Condensed Status

This subsection is applicable to devices supporting Condensed Status (see *Common Practice Command Specification* for more information). The status bits **Failure**; **Out of Specification**; **Function Check**; and **Maintenance Required** are the Condensed Status Bits and used to meet the requirements found in NAMUR NE107. These four bits summarize to the overall status of the field device.

Other status bits found in Command 48 Read Additional Device Status may be mapped to one of the Condensed Status Bits. For standardized Command 48 status bits specified in this document a 'Map' column is included. The "Map" column indicates the default mapping to Condensed Status (F=Failure; C=Function Check; S=Out of Specification; M=Maintenance Required; N=No Effect on Condensed Status bits). Any bit Reserved or Undefined must return the code "Not Defined".

In some cases the mapping can be manipulated/configured. See *Common Practice Command Specification* and the appropriate Device-Specific Document for more information.

Only the single highest priority of the Condensed Status Bits shall be set at any given time. All Condensed Status Bits shall be reset when the device is operating normally. The priority of the Condensed Status Bits (from highest to lowest) is Failure, Function Check, Out of Specification, and Maintenance Required.

Code	Map	Description
0x01	N	**Maintenance Required**. [*Condensed Status*] This bit is set to indicate that, while the device has not malfunctioned, the Field Device requires maintenance. Devices supporting this bit should support the Condensed Status Commands (see *Common Practice Command Specification*).
0x02	S	**Device Variable Alert.** This bit is set if any Device Variable is in an Alarm or Warning State. The host should identify the Device Variable(s) causing this to be set using the Device Variable Status indicators.
0x04	F	**Critical Power Failure.** For devices that can operate from stored power. This bit is set when that power is becoming critically low. For example, a device scavenging power loosing that power source would set this bit. Devices must be able to sustain their network connection for at least 15 minutes from the when this bit is set. A device may begin gracefully disconnecting from the network if its power level drops too low.
0x08	N	**Failure**. [*Condensed Status*] When this bit is set one or more Device Variables (i.e., measurement or control values) are invalid due to a malfunction in the field device or its peripherals. Devices supporting this bit must support the Condensed Status Commands (see *Common Practice Command Specification*).
0x10	N	**Out of Specification**. [*Condensed Status*] When set, this bit indicates deviations from the permissible ambient or process conditions have been detected that may compromise measurement or control accuracy (i.e., device performance may be degraded given current operating conditions). Devices supporting this bit must support the Condensed Status Commands (see *Common Practice Command Specification*).
0x20	N	**Function Check**. [*Condensed Status*] This bit is set if one or more Device Variables are temporarily invalid (e.g. frozen) due to ongoing work on the device. Devices supporting this bit must support the Condensed Status Commands (see *Common Practice Command Specification*).

5.18 Table 18. Lock Device Codes

These codes indicate whether the device has been placed in locked position to prevent any changes from being made manually, from another master, of from any master. Field Devices must support all Lock Device Codes.

Command 76 and Common Table 25 are used to return status of any locks currently asserted in the Field Device.

Code	Lock Device Description
0	Unlocked
1	Lock – Temporary (i.e., Device Reset or Power Loss releases the Lock). Only the locking Master can unlock.
2	Lock – Permanent (i.e., Device Reset or Power Loss does not affect the Lock). Only the locking Master can unlock.
3	Lock All – No changes in the device's configuration, by any master, are allowed. In addition, Device Reset or Power Loss does not affect the Lock. Any Master can unlock.

5.19 Table 19. Write Device Variable Codes

These codes indicate whether the Device Variable's engineering value is forced to a fixed value or is in normal operation.

Code	Write Device Variable Command Description
0	Normal
1	Fixed Value

5.20 Table 20. Device Variable Family Codes

These codes indicate which family the Device Variable belongs to. If the Device Variable does not support Device Family Commands, then 250, "Not Used" must be returned.

Code	Device Variable Family
0-3	Reserved. Must Not be Used
4	Temperature
5	Pressure
6	Valve / Actuator
7	Simple PID Control
8	pH
9	Conductivity
10	Totalizer
11	Level
12	Vortex Flow
13	Mag Flow
14	Coriolis Flow
132 - 249	Reserved. Must Not be Used
250	Not Used

5.21 Table 21. Device Variable Classification Codes

These codes indicate the function performed by the Device Variable. This allows Masters and Host Applications to identify the type of process connection supported by the Device Variable and the Unit Code Expansion table to be used.

Code	Device Variable Classification
0	Device Variable Not Classified
1-63	Reserved
64	Temperature
65	Pressure
66	Volumetric Flow
67	Velocity
68	Volume
69	Length
70	Time
71	Mass
72	Mass Flow
73	Mass Per Volume
74	Viscosity
75	Angular Velocity
76	Area
77	Energy (Work)
78	Force
79	Power
80	Frequency
81	Analytical
82	Capacitance
83	Electromotive Force/Electric Potential
84	Current
85	Resistance
86	Angle
87	Conductance
88	Volume Per Volume
89	Volume Per Mass
90	Concentration
91	Reserved
92	Reserved
93	Reserved
94	Reserved
95	Reserved
96	Acceleration
97	Turbidity
98	Temperature Difference
99	Volumetric Gas Flow (per Second)
100	Volumetric Gas Flow (per Minute)
101	Volumetric Gas Flow (per Hour)

Code   Device Variable Classification

102   Volumetric Gas Flow (per Day)

103   Volumetric Liquid Flow (per Second)

104   Volumetric Liquid Flow (per Minute)

105   Volumetric Liquid Flow (per Hour)

106   Volumetric Liquid Flow (per Day)

107   Thermal Expansion

5.22 Table 22. Trim Point Codes
These codes indicate which trim points that are supported by the Field Device.

Code   Trim Point Supported

0   No Trim Points Supported

1   Lower Trim Point Supported

2   Upper Trim Point Supported

3   Lower And Upper Trim Point Supported

5.23 Table 23. Capture Mode Codes
These codes indicate whether to capture data using the configuration sent in Command 113 Catch Device Variable

Code   Capture Mode

0   Disabled

1   Enabled - Catch data from specified Field Device

2   Enabled - Catch data from BACK message

5.24 Table 24. Physical Layer Type Codes
These codes indicate the kind of Physical Layer sending the message.

Code   Physical Layer Type

0   Asynchronous (e.g., FSK, RS-485)

1   Synchronous (e.g., PSK)

3   Reserved

5.25 Table 25. Lock Device Status

These codes indicate whether the device is locked.

Command 71 and Common Table 18 are used to place locks in the Field Device.

Code   Lock Status

0x01   Device Locked. Must be set if any lock is asserted in the Field Device.

0x02   Lock is Permanent. Must be set if lock does not clear on Device Reset or Power Loss

0x04   Locked by Primary Master (Reset if Secondary Master). Must be set if locked by
       the Primary Master or the Gateway.

0x08   Configuration Locked and cannot be changed by any application. Must be set if "Lock All" code is received
       (see Common Table 18)

0x10   Locked by Gateway. Must be set (along with "Locked by Primary Master") if locked by Gateway.

5.26 Table 26. Analog Channel Flags

These codes are used to clarify Analog Channel functions

Code   Flag Definition

0x01   When set, this Analog Channel is a Field Device analog input channel. In other words, the Field Device has an
       ADC connected to this channel when this bit is set. When reset to zero the Analog Channel is an analig output
       (a DAC is connected to the channel).

5.27 Table 27. Analog Channel Saturated Codes

Any bit not specified is 'Undefined' and must be set to zero.

The "Map" column indicates the default mapping to Condensed Status (F=Failure; C=Function Check; S=Out
of Specification; M=Maintenance Required; N=No Effect). See Common Table 17. Extended Device Status
Codes.

Code	Map	Analog Channel Saturated Description
0x01	S	Analog Channel 1
0x02	S	Analog Channel 2
0x04	S	Analog Channel 3
0x08	S	Analog Channel 4

5.28 Table 28. Analog Channel Fixed Codes

Any bit not specified is 'Undefined' and must be set to zero.

The "Map" column indicates the default mapping to Condensed Status (F=Failure; C=Function Check; S=Out
of Specification; M=Maintenance Required; N=No Effect). See Common Table 17. Extended Device Status
Codes.

Code	Map	Analog Channel Fixed Description
0x01	C	Analog Channel 1
0x02	C	Analog Channel 2
0x04	C	Analog Channel 3
0x08	C	Analog Channel 4

5.29 Table 29. Standardized Status 0

Status commonly used in a wide range of devices and device types. Any bit not specified is 'Undefined' and must be set to zero.

The "Map" column indicates the default mapping to Condensed Status (F=Failure; C=Function Check; S=Out of Specification; M=Maintenance Required; N=No Effect). See Common Table 17. Extended Device Status Codes.

Code	Map	Status Description
0x01	C	**Device Variable Simulation Active**. The device is in simulation mode and one or more of its Device Variables are not representative of the process.
0x02	F	**Non-Volatile Memory Defect**. The Non-Volatile memory check is invalid or maybe corrupt, or the battery of a battery-backed memory is defective.
0x04	F	**Volatile Memory Defect**. The RAM memory check is invalid or maybe corrupt.
0x08	F	**Watchdog Reset Executed**. A watchdog reset has been performed
0x10	S	**Power Supply Conditions Out of Range**. The power source, supply or voltage is outside its allowable range
0x20	S	**Environmental Conditions Out of Range**. An internal or environmental condition is beyond acceptable limits.
0x40	F	**Electronic Defect**. A hardware problem not related to the sensor has been detected.
0x80	N	**Device Configuration Locked.** Device is in write-protect or is locked.

5.30 Table 30. Standardized Status 1

Status commonly used in a wide range of devices and device types. Any bit not specified is 'Undefined' and must be set to zero.

The "Map" column indicates the default mapping to Condensed Status (F=Failure; C=Function Check; S=Out of Specification; M=Maintenance Required; N=No Effect). See Common Table 17. Extended Device Status Codes.

Code	Map	Description
0x01	N	**Status Simulation Active.** Status Simulation Mode has been enabled and the Device Status and the status bits being returned in the Command 48 response are fixed and may not represent the current state of the device.
0x02	C	**Discrete Variable Simulation Active.** The device is in simulation mode and one or more of its Discrete Variables are not representative of the process.
0x04	N	**Event Notification Overflow.** This bit must be set when the event queue for one or more Event Specification (See Event Notification in *Common Practice Command Specification*) overflows resulting in an event not be recorded. This bit must be reset when all pending events have been acknowledged

5.31 Table 31. Standardized Status 2

Any bit not specified is 'Undefined' and must be set to zero.

The "Map" column indicates the default mapping to Condensed Status (F=Failure; C=Function Check; S=Out of Specification; M=Maintenance Required; N=No Effect). See Common Table 17. Extended Device Status Codes.

Code	Map	Description
0x01	N	**Sub-Device List Changed**. When set, the I/O system has lost communication with one of its sub-devices or discovered a new sub-device. Issuing Command 74 to read "Number of devices detected" resets this bit[3]. The current sub-device list is read using Command 84.
0x02	M	**Duplicate Master Detected.** The Adapter has discovered another master with the same address connected to its token-passing interface.
0x04	M	**Sub-Device Mismatch**. One or more of the sub-devices connected to the I/O system do not match the stored/pre-configured value.
0x08	N	**Sub-Devices with Duplicate IDs Found.** Sub-Devices with Duplicate Unique IDs or Long Tags found connected to the I/O System.
0x10	S	**Stale Data Notice**. This bit is set when the Stale Data Alarm for any Sub-device is set.

5.32 Table 32. Standardized Status 3

The status byte is reserved for WirelessHART standardized status. Any bit not specified is 'Undefined' and must be set to zero.

The "Map" column indicates the default mapping to Condensed Status (F=Failure; C=Function Check; S=Out of Specification; M=Maintenance Required; N=No Effect). See Common Table 17. Extended Device Status Codes.

Code	Map	WirelessHART Status Description
0x01	M	**Capacity Denied**. The device was unable to acquire the communication bandwidth required to support the Burst Messaging specified. This must also be set if the Network Manager reduces the bandwidth allocated to the device. Gateway must set this bit when any device in the network has insufficient bandwidth.
0x02	N	**Reserved.** Must be set to 0
0x04	N	**Bandwidth allocation pending.** The device has asked for bandwidth from the Network Manager and is awaiting Network Manager response.
0x08	N	**Block Transfer Pending**. The device has a data set (e.g., a waveform) awaiting transfer to the host application or Gateway. The Gateway should open the block transfer port and transfer the data.
0x10	F	**Radio Failure.** The radio or radio module has failed and the device needs to be serviced or replaced. The "Device Malfunction" bit in the Device Status byte must be set when this bit is set.

---

[3] "Sub-Device List Changed" does not necessarily indicate the number of devices has changed (e.g., a device may have been replaced).

5.33 Table 33. Burst Message Trigger Mode
Indicates the trigger condition for bursting a message.

Code   Burst Message Trigger Mode Description

0   **Continuous**. The Burst Message is published continuously at (worst case) the Minimum Update Period.

1   **Window**. The Burst Message is triggered when the source value deviates more than the specified trigger value.

2   **Rising**. The Burst Message is triggered when source value Rises Above the specified trigger value.

3   **Falling**. The Burst Message is triggered when the source value Falls Below the specified trigger value.

4   **On-Change**. The burst message is triggered when any value in the message changes.

5.34 Table 34. Device Variable Code
These Device Variable Codes supplements the device's array of Device Variables to allow access to the process measurements and loop current historically returned in Command 3. Since all of these codes are standardized, these Device Variables are not included in the count returned by "Maximum Number of Device Variables" in Command 0. With the exception of "Battery life", devices must support all of these Device Variables. "Battery life" must be supported by all devices that are battery powered. The Device Variable Status bits must be supported for all Dynamic Variables and the Loop Current.

The Superset of this table, including the device's Device Variables, must be included in the manufacturer's device-specific document.

Code   Device Variable Code Description

243   Battery life (Float in Days)

244   Percent Range

245   Loop Current

246   Primary Variable

247   Secondary Variable

248   Tertiary Variable

249   Quaternary Variable

250   Not Used (This code must only be returned when the Protocol command requirements are met. See, for example, *Common Practice Command Specification*).

5.35 Table 35. Event Notification Control Code
Code   Event Notification Control Code Description

0   Off

1   Enable Event Notification on Token-Passing Data Link Layer

2   Enable Event Notification on TDMA Data-Link Layer

3   Enable Event Notification on TDMA and Token-Passing Data Link Layers

5.36 Table 36. Event Status
Code   Event Status Description

0x01   Configuration Changed Event Pending

0x02   Device Status Event Pending

0x04   More Status Available Event Pending

5.37 Table 37. Trend Control Codes

Code   Trend Control Codes Description

0   Disable

1   Enable Single Data Point Trending

2   Enable Filtered Trending. The sample is filtered using a time constant equal to one-third the trend sample period.

3   Enable Average Trending (optional). In other words, the value obtained by dividing the sum of all samples in the period by the total number of samples.

5.38 Table 38. Time-set Code

Code   Time-set Code Description

0   Read Receive Time

1   Write Date and Time

5.39 Table 39. Timetable Request Flags

Each bit is set or reset as needed to indicate the communication requirements being requested. For example, a bi-directional timetable request would set both the Source and Sink bits[4].

Code   Timetable Request Flags Description

0x01   Source

0x02   Sink

0x04   Intermittent

5.40 Table 40. Timetable Application Domain

Code   Timetable Application Domain Description

0   Publish

1   Event

2   Maintenance

3   Block Transfer

---

[4] At lest one on of the Source or Sink bits must be set.

5.41 Table 41. Synchronous Action Control

Code Synchronous Action Control Description

0x01   **Command**. When set the indicated command will be executed at the time indicated. When reset a Device Variable is to be sampled.

0x10   **One-Shot**. When set the synchronous action will be performed one time only. When reset the sampling will trigger at the indicated time and repeat continuously there after.

0x80   **Action Enabled**. When set the action is enabled. When action is a "One-Shot" then the enabled bit is reset after the Action occurs.

5.42 Table 42. Real-Time Clock Flags

Code Real-Time Clock Flags Description

0x01   **Non-Volatile Clock**. When set the device contains a battery-backed clock. In this case, the clock does not need to be reset if there is a power failure.

0x02   **Clock Uninitialized**. The real-time clock has never been set with the date and time. For example, the clock is volatile and power was removed from and restored to the device.

5.43 Table 43. Wireless Timer Code

Code Wireless Timer Code Description

0   Discovery

1   Advertisement

2   Keep-Alive

3   Path Failure

4   Health Report

5   Broadcast Reply

6   Maximum PDU Age (maxPacketAge)

7   Maximum Reply Time (Transport Layer retry interval)

5.44 Table 44. Device Power Source

Code Description

0   **Line Power**. Device is powered via a hardwired connection to a plant power source

1   **Battery Power**. Device operates solely off its (internal) battery.

2   **Rechargeable Battery Power or Power Scavenging**. The device has a short-term supply of energy (must be at least one hour) that is continuously being replenished. The device's power is being replenished by harvesting and converting energy from the environment surrounding the device (e.g., solar, vibration, heat).

5.45 Table 45. Link Type

Code   Link Type Description

0   Normal

1   Discovery

2   Broadcast

3   Join[5]

5.46 Table 46. Link Option Flag Codes
Either Transmit, Receive or both must be set.

Code   Link Option Flag Codes Description

0x01   Transmit

0x02   Receive

0x04   Shared

5.47 Table 47. Superframe Mode Flags

Code   Superframe Mode Flags Description

0x01   Active (reset = inactive)

0x80   Handheld Superframe. This bit must only be set for one Superframe in the device.

5.48 Table 48. Session Type Code

Code   Session Type Code Description

0   Unicast

1   Broadcast

2   Join

5.49 Table 49. Timetable Deletion Reason Codes

Code   Service Deletion Reason Codes Description

0   Requested by peer

1   Service can not be established

2   Network failure

5.50 Table 50. Disconnect Cause Codes

Code   Disconnect Cause Codes Description

0   User-initiated

1   Communication failure

---

[5]Once joined to the network, device shall not assume TX Join link is Shared.

5.51 Table 51. Wireless Operation Mode
This table is used primarily to monitor the join process.

Code Wireless Operation Mode Description

0   Idle.

1   Active Search.

2   Negotiating.

3   Quarantined.

4   Operational.

5   Suspended

6   Deep sleep/Ultra-low Power/Passive Search

7-15   Reserved

5.52 Table 52. Join Process Status
This table is used primarily to monitor the join process.

Code Join Status Description

0x001 Network Packets Heard.

0x002 ASN Acquired.

0x004 Synchronized to Slot Time.

0x008 Advertisement Heard.

0x010 **Join Requested**. Set on transmission of first join request

0x020 **Join Retrying**. Set after the first join request retry (i.e., when number of join requests > 1). Cleared when device is Authenticated or when Active Search started.

0x040 **Join Failed**. Set on transition from Active Search mode to Deep Sleep mode. Cleared on transition from Deep Sleep to Active Search.

0x080 **Authenticated**. Network Key, Network Manager Session Established

0x100 **Network Joined**. Normal superframe and links obtained.

0x200 **Negotiating Network Properties**. Gateway session obtained. Initial Bandwidth requirements being negotiated with Network Manager.

0x400 Normal Operation Commencing.

5.53 Table 53. Security Type Codes
Security best practices may evolve over time. This table allows for backward-compatible improvements in security should that be required in the future.

Code Security Type Codes Description

0   Session Keyed

1   Join Keyed

2   Reserved

5.54 Table 54. SI Units Control Code
Code   SI Units Control Code Description

0   No restrictions (default)

1   Unit codes limited to the SI Units only

5.55 Table 55. Device List Code

These lists are maintained by devices (e.g., Network Manager and Gateway) to provide lists of field devices, for example, participating, active, allowed or not allowed in a WirelessHART Network.

Code **Device List Code Description**

0   Active Device List (Mandatory-Gateway). The devices currently joined and available to Host Applications (i.e., the are not Quarantined). Active Device List is volatile.

1   Whitelisted Devices (optional). Devices that are allowed to join the Network. This is similar to an Access Control List (ACL). Whitelist is non-volatile.

2   Blacklisted Devices (optional). Devices that are not allowed to join the Network. Blacklist is non-volatile.

3   Network List (Mandatory-Gateway). The devices that are (or should be) part the Network (including Access Points). Includes the Active list plus devices that have joined Network but have currently dropped off the Network. Network list must track quarantined devices that have not been approved (i.e., quarantined devices that have not been approved and, consequently, never been in the Active list). Network List is non-volatile

4   Quarantine List (Mandatory-Gateway). These are devices that have successfully joined the network but are not approved for use managing the plant/process (i.e., quarantined devices cannot be accessed by Gateways, Host Applications or wirelessly by Handhelds). Quarantined devices must not be included in the Active List but must be included in the Network List. Quarantine List is volatile

5   Rejected Device List (Optional-Gateway). This is the list of devices that have attempted to join the network but have had their join request discarded (i.e. access to the network was denied).
        Rejected Device List is volatile

6   Access Point List (Mandatory-Gateway). The list of Access Points connected to the Gateway. Access Points must be included in the Network List and must not be included in the Active List.
        Access Point List is volatile.

5.56 Table 56. Network Access Mode Code

The Network Access Mode controls the level of security employed when allowing device to join the Network. Irrespective of the Network Access Mode, Join Key must be used to authenticate devices attempting to join the Network.

Code **Network Access Mode Code Description**

0   Open – Use only Join Key to authenticate devices attempting to Join (no access control list used).

1   Use Whitelist. Only devices on the Whitelist are allowed to Join

2   Use Blacklist. Devices on the Blacklist are **NOT** allowed to Join

3   Use Whitelist and Blacklist. Only devices on the Whitelist and not on the Blacklist are allowed to Join

4   Lockdown. No new devices may join the network. Only devices on the Network List may join and participate in the network (Network list is non-volatile - see Common Table 55)

5   Quarantine. All authenticated devices are allowed to join. Devices on the Network List are made active (i.e., provisioned with the Gateway session and added to the Active List). All other devices are quarantined (i.e, added to the Quarantine List). After network operator approval Quarantined devices are made active.

5.57 Table 57. Device Profile Code

Code   Device Profile Code Description

1   Process Automation Device

2   Discrete Device

3   Hybrid: Process Automation + Discrete

4   I/O System

129   WirelessHART Process Automation Device

130   WirelessHART Discrete Device

131   WirelessHART Hybrid: Process Automation + Discrete

132   WirelessHART Gateway

140   WirelessHART Access Point

141   WirelessHART Process Adapter

142   WirelessHART Discrete Adapter

144   WirelessHART-Enable Handheld/Portable Maintenance Tool

5.58 Table 58. Device Power Status

Code   Device Power Status Code Description

0   Nominal

1   Low

2   Critically Low

3   Recharging - Low

4   Recharging - High

5.59 Table 59. Neighbor Flags

Code   Neighbor Flags Code Description

0x01   Time Source (can be written using Command 971)

0x80   (Read-Only) No links to this Neighbor

5.60 Table 60. Change Notification Flags

The following flags allow Client Applications to specify (by setting the appropriate bit below) when an I/O System must generate a Change Notification.

Code   Network Access Mode Code Description

0x0001 **Process Data**. Change Notification upon a change in process data value or status.

0x0002 **Event Notification**. Change Notification when a new Event Notification is received.

0x0004 **Device Status**. Change Notification on change in Device Status or Extended Device Status.

0x0008 **Device Configuration**. Change Notification on change in the Configuration Changed Counter value.

0x0010 **Network Topology**. Change Notification on change in the I/O System's sub-device topology (e.g., a Field Device is added to or removed from the I/O System).

0x0020 **Network Schedule**. Change Notification on a change in the sub-device communication rate (e.g., a burst message in a Field Device is added or removed).

0x0040 **Device List Changed** (I/O System must be a Gateway).

5.61 Table 61. Join Mode Code

Code   Link Type Description

0   Don't attempt to Join

1   Join now[6]

2   Attempt to join immediately on Powerup or reset.

5.62 Table 62. Device Scheduling Flags

Code   Scheduling Flags Description

0x01   Transient Device

0x02   Non-routing Device

0x04   Handheld Device

5.63 Table 63. Network Optimization Flags

Code   Scheduling Flags Description

0x01   Low Latency (reset = Long Battery Life)

0x02   Use Line Powered Devices as Backbone

5.64 Table 64. Packet Receive Priority Code

Code   Link Type Description

0   Command (Highest Priority)

1   Process Data

2   Normal

3   Alarm (Lowest Priority)

5.65 Table 65. Device Variable Property Codes

Code   Description

0x01   Device Variable is not calculated by Field Device.

0x02-   Undefined. Must not be set by any implementation.
0x40

0x80   Device Variable is being simulated This bit must not be set if Device Variable is not calculated in the Field
            Device (e.g., Device Variable is setpoint or remote sensor value)

---

[6] Upon reception of a "Join now" the Field Device must return "Join now" while in Active Search (See *Network Management Specification*). Upon leaving Active Search mode the device must answer subsequent queries with "Attempt to join immediately on Powerup or reset:

5.66 Table 66. Squawk Control Codes

Code	Description
0	Off
1	On
2	Squawk Once (for duration of squawk see device specific document)

5.67 Table 67. Event Manager Registration Control Codes

Code	Description
0	Register
1	De-Register. The Event Manager is canceling its registration
2	Reset. Resets the Event Manager registration. No mater the source of the command request, after this is received no Event Manager is registered.

5.68 Table 68. Event Manager Registration Status Codes

Code	Description
0x01	Event Manager registered
0x02	Requesting client is Event Manager. The client issuing the command is the Event Manager

5.69 Table 69. Location Method Codes

Location Method Codes are based on US National Marine Electronics Association (NMEA) standard NMEA 0183 $GPGGA "sentence".

Code	Description
0	No fix
1	GPS or Standard Positioning Service (SPS) fix
2	Differential GPS fix
3	Precise positioning service (PPS) fix
4	Real Time Kinematic (RTK) fixed solution
5	Real Time Kinematic (RTK) float solution
6	Estimated dead reckoning
7	Manual input mode
8	Simulation mode

5.70 Table 70. Condensed Status Mapping Code

The Device Status Mapping Code maps individual status bits to Condensed Status.

Code	Description
0	No Effect. The status bit does not affect Condensed Status.
1	Maintenance Required ("M")
2	Reserved
3	Failure ("F")
4	Out of Specification ("S")
5	Function Check ("C")
6	Not Defined (e.g., status bit is not supported by the Field Device[7])
7-15	Undefined

5.71 Table 71. Status Simulation Mode Codes

Code	Description
0	Disabled
1	Enabled

5.72 Table 72. Simulated Value Code Codes

Code	Description
0	Reset
1	Set

5.73 Table 73. Sub-device Assignment Status Codes

The bits in this table indicates mismatches with the Live Sub-Device list returned in Command 84.

Code	Description
0x01	**Device Not Found: Unique ID (Error)**. A Sub-device with the Unique ID (Expanded Device Type Code + Device ID) not found on the Live Sub-device list.
0x02	**Device Not Found: Long Tag (Error)**. A Sub-device with the Long Tag not found on the Live Sub-Device list.
0x04	**Older Device Revision (Error).** Sub-device on Live List is older device revision then expected.
0x08	**Newer Device Revision (Warning).** Sub-device on Live List is newer device revision then expected.

---

[7] Command 48 is truncatable and it not possible to map bytes not returned to Condensed Status. Furthermore, not all bits returned in Command 48 are actually used by the Field Device (i.e., the bits are "Undefined"). Consequently this code is only applicable to "Undefined" bits in the Command 48 response.

5.74 Table 74. Sub-device Assignment Transfer Codes

Code   **Description**

Code	Description
0	**Transfer All Device Identity**. Transfers all Sub-device identity including Expanded Device Type Code, Device ID and LongTag.
1	**Transfer All Except Device ID**.

5.75 Table 75. Wireless Capability Flags (for Command 777)

Code   **Description**

Code	Description
0x01- 0x04	Reserved
0x08	Saturating Counters (reset= Rollover Counters). When this bit is set (not recommended) the status counter in, for example, Command 779 are reset after each Health Report. If this bit is reset the counters are never reset and rollover when the maximum value (e.g., 0xFFFF) is surpassed.

5.76 Table 76. CCA Mode Codes

Code   **Description**

Code	Description
0	CCA Disabled
1	CCA Enabled. Mode 1: Energy Detect
2	CCA Enabled. Mode 2: Carrier Sense
3	CCA Enabled. Mode 3: Carrier Sense + Energy Detect

5.77 Table 77. Wireless Device Connection Status (for Command 840)

Code   **Description**

Code	Description
1	**Device Operational**. Device is currently connected to the network
2	**Device Disconnected**. Device is NOT connected to the network (i.e., a Transport Layer failure has occurred; Path Down Alarm received on all connections to the Field Device; or the Gateway session does not exist).
3	**Device Attempting to Join**. Join request has been received from the device but join sequence has not been completed
4	**Device Quarantined**. Device has successfully joined the network but is currently not producing process data. Device cannot be accessed via the Gateway.
7	Reserved.

5.78 Table 78. Wireless Device Health Status (for Command 840)

Code	Description
0x01-0x08	Reserved
0x10	**Stale Data Alarm**. Stale Data Count Setpoint exceeded. If Stale Data Alarm is set for any Field Device then "Stale Data Notice" must be returned in Command 48 response (see Common Table 31)

5.79 Table 79. Change Key Flag Codes (for Command 851)

Code	Description
0x01	**Network Key**.
0x02	**Join Key**.
0x04	**Session Keys**.

5.80 Table 80. Join Key Mode Code

Code	Network Access Mode Code Description
0	Normal. Default Mode: Each device has a different join key.
1	Common Join Key. All devices use the same join key.
2	"Well-known" Key. All devices use the "well-known" key (7777 772E 6861 7274 636F 6D6D 2E6F 7267 hexadecimal) as their join key.

ANNEX A.   TABLES FROM *COMMAND SUMMARY SPECIFICATION*

(Informative) For detailed specifications see the *Command Summary Specification*.

A.1.   Table A-1. Device Status

The Device Status is included in both Token-Passing Data-Link Layer response PDUs and Wireless Network Layer response PDUs. Device Status indicates the current operating status of the field device as a whole and is not associated with the completion of any command. The status bits in the Device Status Byte are summarized as follows:

Code	Map	Description
0x01	S	**Primary Variable Out of Limits**. The PV is beyond its operating limit.
0x02	S	**Non-Primary Variable Out of Limits**. A Device Variable not mapped to the PV is beyond its operating limits.
0x04	S	**Loop Current Saturated**. The Loop Current has reached its upper (or lower) endpoint limit and cannot increase (or decrease) any further.
0x08	N	**Loop Current Fixed**. The Loop Current is being held at a fixed value and is not responding to process variations.
0x10	N[8]	**More Status Available**. More status information is available via Command 48, Read Additional Status Information.
0x20	N	**Cold Start**. A power failure or Device Reset has occurred.
0x40	N[8]	**Configuration Changed**. An operation was performed that changed the device's configuration.
0x80	N	**Device Malfunction**. The device detected a serious error or failure that compromises device operation.

A.2.   Table A-2. Communication Status

This byte is specific to the Token-Passing Data-Link Layer and is multiplexed with the Response Code byte. The Communication Status is only returned when a communication error is detected.

Code	Description
0x01	**Reserved**. Must be set to zero
0x02	**Buffer Overflow**. The message was too long for the receive buffer of the device.
0x04	**Reserved**. Must be set to zero
0x08	**Longitudinal Parity Error**. The Longitudinal Parity calculated by the device did not match the Check Byte at the end of the message.
0x10	**Framing Error**. The Stop Bit of one or more bytes received by the device was not detected by the UART (i.e. a mark or 1 was not detected when a Stop Bit should have occurred)
0x20	**Overrun Error**. At least one byte of data in the receive buffer of the UART was overwritten before it was read (i.e., the slave did not process incoming byte fast enough).
0x40	**Vertical Parity Error**. The parity of one or more of the bytes received by the device was not odd.
0x80	**1**. This bit must always be set to indicate a communication error

---

[8] This mapping is fixed and must not be changed. Any attempt to modify must result in an" Invalid Selection" error Response Code from the Field Device.

A.3.　　　Device Variable Status
All cyclical process data include a Device Variable Status byte.

Bits　　**Description**

7-6　　**Process Data Status**. Overall status of the Device Variable value.

　　　　　　　3　　　　**Good**
　　　　　　　2　　　　**Manual/Fixed**
　　　　　　　1　　　　**Poor Accuracy**
　　　　　　　0　　　　**Bad**

5-4　　**Limit Status**. Indicates whether the Device Variable is responding to process changes.

　　　　　　　3　　　　**Constant**
　　　　　　　2　　　　**High Limited**
　　　　　　　1　　　　**Low Limited**
　　　　　　　0　　　　**Not Limited**

3　　**More Device Variable Status Available**. Set if expanded Device Family Status Command contains diagnostic information that is useful to the Host Application. Must be reset to zero is Device Variable does not support any Device Family.

2-0　　**Device Family Specific Status**. Specified by corresponding Device Family. Must be reset to zero is Device Variable does not support any Device Family.

ANNEX B.   REVISION HISTORY

B.1.   Modifications from Revision 21.0 to Revision 22.0

Specification enhanced to support Condensed Status per NAMUR NE 107. This includes

Extensive enhancements to Table 17 along the definition of 3 more status bits;

Addition of a "Map" column containing default Condensed Status mapping to all Tables containing standardized status;

Table 1 has been modified to reflect the addition of new Device Type Codes.

Table 2.73 has been modified to reflect the addition of new unit codes.

Table 2.79 has been modified to indicate Watt is base SI unit.

Table 2.84 has been modified to reflect the addition of new unit codes.

Table 2.97 Added (Turbidity)

Clarifications added to Tables 14, 18, 25, 26, 29, 31, 53, 60

Table 21 has been modified to reflect addition of new classification codes.

Table 30, 31, 32 have been modified to reflect addition of new standardized status.

Table 43 has been modified to reflect addition of new timer codes.

Table 55 has been modified to reflect addition of new device list codes.

Table 56 has been modified to reflect addition of new access mode codes.

Table 59 has been modified to reflect addition of new neighbor flags.

New Table 64 added.

(Informational) Annex A has been added summarizing Device Status, Communication Status, and Device Variable Status.

B.2.   Modifications from Revision 20.0 to Revision 21.0

Table 1 has been modified to reflect the addition of new Device Type Codes.

Table 2.85 has been modified to reflect the addition of new unit codes.

Table 2.90 has been modified to reflect the addition of new unit codes.

Table 2.96 (Acceleration Unit Codes) added.

Table 8 has been modified to reflect the assignment of new Manufacture Codes.

Table 10 – note added to code "6".

Tables 11, 17, 27, 28, 36, 41, and 42 are bit fields and the formatting of the codes were corrected accordingly.

In Table 32, the bit 0x02, "Duplicate Master Detected" was deleted. It was inadvertently left in Table 32 from an unreleased preliminary version or revision 19 and corrected in this version. It was also a duplicate of the same bit in Table 31

Fixed headings in Table 25

Table 39 and 40 was renamed to be consistent with terminology used elsewhere in the Protocol Specifications.

Table 57 A profile code was added for Access Points

B.3. Modifications from Revision 19.0 to Revision 20.0

Table 1 has been modified to reflect the addition of new Device Type Codes. Several existing codes have been corrected.

Table 2.73 has been modified to reflect the assignment of a new unit code – milligrams per liter (170).

Table 2.85 has been modified to reflect the assignment of a new unit code – mega ohms (170). Unit code "KOhms" (163) was changed to "kilo ohms".

Table 8 has been modified to reflect the assignment of new Manufacturer Codes.

B.4. Modifications from Revision 18.0 to Revision 19.0

Table 1 has been modified to reflect the addition of new Device Type Codes.

Table 8 has been modified to reflect the assignment of new Manufacture Codes.

Two Codes are added to Common Table 31, Standardized Status 2: one for I/O Systems to indicate changes in its device list; the other to indicate detection of a master with the same address as the I/O system.

In Common Table 32, the status " Bandwidth allocation pending" was added and use of "Capacity denied" was clarified.

To support bursting of Command 48 an "On-Change" enumeration is added to Common Table 33, Burst Message Trigger Mode.

Device Variable "Battery Life" is added to Common Table 34, Device Variable Code. "Battery Life" is mandatory only for battery-powered devices. In addition, the Code for "Percent Range " was corrected.

In Common Table 51, Wireless Operation Mode, Code 0 was improperly overloaded. This was improved by reserving Code 0 for Idle only. Deep sleep/Ultra-low Power/Passive Search is added as a separate code.

In Common Table 57, Device Profile Code, additional codes for wireless, process automation, and discrete types are added.

In Common Table 59. Neighbor Flags, the Keep-Alive Pending and Path Failure flags were removed.

Front page of the document reformatted to reflect the new HCF logo.

B.5. Modifications from Revision 17.0 to Revision 18.0
Addition of Common Tables 27-57 to support HART 7

Updated Expanded Device Type and Manufacturer ID tables as well.

B.6. Modifications from Revision 16.0 to Revision 17.0
The last revision to the document titled: 'HART-Smart Communications Protocol, Common Tables' as HCF_SPEC-183, Revision 16.0. For Revision 17.0, the document tables have been updated to reflect the following changes:

Sub-tables in Table 1 (Device Type Codes) have been combined into one table now showing Expanded Device Codes. The following Device Type Codes have been added:

ExpandeDevice Code(Hex)	Description	Company Name
E085	3DLevelScanner M	AMP
E086	3DLevelScanner S	AMP
E087	3DLevelScanner L	AMP
E08A	R3x	BARTEC
E084	SS	Daehan Control
E08B	700 Bridge	Detcon
E080	ESD3000	ExSaf
C680	TORRIX	FAFNIR
141E	Vortex 84	Foxboro
DF80	FL4000	General Monitors, Inc.
68EF	BECK-MK2	Harold Beck and Sons
CF80	EP1000/SPS200	Koso
45E2	ESK2A	Krohne
45E4	Optiflex 1300C	Krohne
45E5	Optiwave 7300C	Krohne
E08D	CMM-01 MASS FLOW	METROVAL
E08C	UltimaXL/XT	MSA
E088	EX200H Positioner	ORANGE INST UK
E089	IS200H Positioner	ORANGE INST UK
B580	Series642	Pyromation Inc.
E082	SDT420	SEOJIN INSTECH
D485	HVP1114	SIC
D480	PES	SIC
3E0A	LD400	Smar
837E	IP8101	SMC
E083	RT-Ex15	TASI FLOW
B003	MACX MCR-S-MUX 16 ch	Phoenix Contact
B004	MACX MCR-S-MUX 32 ch	Phoenix Contact
1A05	2600T-364	ABB
2A19	SITRANS FC MASSFLO	Siemens
	HPort	
3B21	3300	Mobrey
5D01	KFD2	Pepperl Fuchs
5DEF	KFD2-HMM-16	Pepperl Fuchs
65CA	SVI II AP	Masoneilan-Dresser
111A	DeltapilotS	Endress & Hauser
111B	FMU9x	Endress & Hauser
360C	MAGNEW4W	Yamatake
866B	APT3100	Duon System
1161	P_FLOW92	Endress & Hauser
1162	P_FLOW91	Endress & Hauser

ExpandeDevice Code (Hex)	Description	Company Name
1303	DVC6000	Fisher Controls
1707	STT17H	Honeywell
2004	THZ2	Moore Industries
4901	HPSM	Elcon Instruments
8661	APT3200	Duon System

The following Device Type Codes have been modified:

ExpandeDevice Code (Hex)	Description	Company Name
54F8	MSP2002	Siemens Milltronics PI
54F9	MST9500	Siemens Milltronics PI
57EE	ND820/T	Metso Automation
61EB	2211 pH	Knick

Changes to Table 8. Manufacturer Identification Codes

Enumeration(s) added:

224	00E0	Manucturer Expansion
249	00F9	HART Communication Foundatio
24576	6000	Ex
24577	6001	SEOJIN INSTECH
24578	6002	TASI FLOW
24579	6003	Daehan Control
24580	6004	APM
24581	6005	ORANGE INST. UK
24582	6006	BARTEC
24583	6007	Detcon
24584	6008	MSA
24585	6009	METROVAL
24586	600A	Etalon Rus

Enumeration(s) modified:

81	51	– changed to Sensidyne

B.7.   Modifications from Revision 15.0 to Revision 16.0

The last revision to the document titled: 'HART-Smart Communications Protocol, Common Tables', was HCF_SPEC-183, Revision 15.0. For Revision 16.0, the document tables have been updated to reflect the following changes:

Added Device Type Code tables

Table 1.71 Druck Device Type Codes
Table 1.130 Tokyo Keiso Device Type Codes
Table 1.146 Phase Dynamics Device Type Codes
Table 1.182 Satron Instruments Device Type Codes
Table 1.191 GP:50 Device Type Codes
Table 1.206 Roost Device Type Codes

Changes to Table 1.20 Foxboro Device Type Codes
Enumeration(s) added:
        54
Enumeration(s) modified:
        None

Changes to Table 1.22 ABB Device Type Codes
Enumeration(s) added:
        135
Enumeration(s) modified:
        None

Changes to Table 1.23 Honeywell Device Type Codes
Enumeration(s) added:
        5, 6
Enumeration(s) modified:
        None

Changes to Table 1.26 ABB Device Type Codes
Enumeration(s) added:
        35, 36 37, 38, 140
Enumeration(s) modified:
        None

Changes to Table 1.29 M-System Co Device Type Codes
Enumeration(s) added:
        3
Enumeration(s) modified:
        None

Changes to Table 1.31 Micro Motion Device Type Codes
Enumeration(s) added:
        52
Enumeration(s) modified:
        None

Changes to Table 1.38 Rosemount Motion Device Type Codes
Enumeration(s) added:
        58
Enumeration(s) modified:
        None

Changes to Table 1.42 Siemens Device Type Codes
Enumeration(s) added:

19, 29
Enumeration(s) modified:
       None

Changes to Table 1.55 Yokogawa Device Type Codes
Enumeration(s) added:
       83, 84
Enumeration(s) modified:
       None

Changes to Table 1.69 Krohne Device Type Codes
Enumeration(s) added:
       227
Enumeration(s) modified:
       None

Changes to Table 1.71 Druck Device Type Codes
Enumeration(s) added:
       233, 236, 239
Enumeration(s) modified:
       None

Changes to Table 1.86 Magnetrol Device Type Codes
Enumeration(s) added:
       229
Enumeration(s) modified:
       None

Changes to Table 1.87 Metso Automation Device Type Codes
Enumeration(s) added:
       228, 229
Enumeration(s) modified:
       None

Changes to Table 1.130 Tokyo Keiso Device Type Codes
Enumeration(s) added:
       123, 127
Enumeration(s) modified:
       None

Changes to Table 1.146 Phase Dynamics Device Type Codes
Enumeration(s) added:
       127
Enumeration(s) modified:
       None

Changes to Table 1.182 Satron Instriments Device Type Codes
Enumeration(s) added:
       127
Enumeration(s) modified:
       None

Changes to Table 1.191 GP:50 Device Type Codes
Enumeration(s) added:
       124
Enumeration(s) modified:
       None

Changes to Table 1.197 Kajaani Process Measurements Device Type Codes
Enumeration(s) added:
        129
Enumeration(s) modified:
        None

Changes to Table 8. Manufacturer Identification Codes
Enumeration(s) added:
        209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223
Enumeration(s) modified
    108 - changed to " Bopp and Reuther Messtechnik"

Changes to Table 20. Device Variable Family Codes

        Enumeration(s) added:
        11, 12, 13, 14

        Enumeration(s) removed:
        None
Enumeration(s) modified:
        None

Changes to Table 21. Device Variable Classification Codes

        Enumeration(s) added:
        92, 93, 94, 95

        Enumeration(s) removed:
        None
Enumeration(s) modified:
        None

B.8.   Modifications from Revision 14.0 to Revision 15.0

The last revision to the document titled: 'HART-Smart Communications Protocol, Common Tables', was HCF_SPEC-183, Revision 14.0. For Revision 15.0, the document tables have been updated to reflect the following changes:

Added Device Type Code tables

Table 1.19 Fisher Controls Device Type Codes

Table 1.29 M-System Co Device Type Codes

Table 1.93 Pepperl Fuchs Device Type Codes

Table 1.99 MTS Systems Corp. Device Type Codes

Table 1.100 Oval Device Type Codes

Table 1.117 Klay Device Type Codes

Table 1.128 Danfoss Device Type Codes
Table 1.37 Ronan Device Type Codes

Table 1.142 Mettler Toledo Device Type Codes

Table 1.143 Det-Tronics Device Type Codes

Table 1.157 Panametrics Device Type Codes

Table 1.159 Analytical Technology Inc. Device Type Codes

Table 1.157 FINT Device Type Codes

Table 1.162 InterCorr Device Type Codes

Table 1.166 InterCorr Device Type Codes

Table 1.171 Tyco Valves & Controls Device Type Codes

Table 1.176 Phoenix Contact Device Type Codes

Table 1.178 Amer. Level Instr. Device Type Codes

Table 1.181 Pyromation Inc. Device Type Codes

Table 1.189 Badger Meter Device Type Codes

Table 1.194 Hengesbach Device Type Codes

Table 1.202 Spirax Sarco Italy Device Type Codes

Changes to Table 1.10 Brooks Instrument Device Type Codes
Enumeration(s) added:
        4
Enumeration(s) modified:
        None

Changes to Table 1.17 Endress & Hauser Device Type Codes
Enumeration(s) added:
        23, 24, 30, 67, 69, 82, 87, 88, 89, 182, 201, 202, 203
Enumeration(s) modified:
        17, 18, 19, 20

Changes to Table 1.20 Foxboro Device Type Codes
Enumeration(s) added:
        53, 56, 125
Enumeration(s) modified:
        None

Changes to Table 1.23 Honeywell Device Type Codes
Enumeration(s) added:
        5
Enumeration(s) modified:
        8

Table 1.25 Thermo Measuretech Device Type Codes

        Enumeration(s) added:
        11

Enumeration(s) modified:
        8, 9, 15

Changes to Table 1.26 ABB Automation Device Type Codes
Enumeration(s) added:
        3, 4, 29, 137
Enumeration(s) modified:
        None

Changes to Table 1.31 Micro Motion Device Type Codes

        Enumeration(s) added:
        36, 37, 38, 39, 41, 65

        Enumeration(s) modified:
        7 ,20, 21, 30

Changes to Table 1.33 Moore Products Device Type Codes
Name change from Moore Products to PRIME Measurement Products
Enumeration(s) added:
        None
Enumeration(s) modified:
        None

Changes to Table 1.38 Rosemount Device Type Codes

        Enumeration(s) added:
        54, 55, 56, 60, 64, 66, 67, 68, 69, 71

        Enumeration(s) modified:
        1 - changed to "3051"

                2 – change to "3044 Temp"

                3 – change to "1151"

                4 - change to "Magmeter"

                5 - change to "2001"

                6 - change to "3051C"

                8 - change to "4050"

                11 - change to "3001L HTG"

                12 - change to " Mag HS"

                13 - change to "3044C Temp"

                14 - change to "3001C HTG"

                15 - change to "3051C LP"

                16 - change to " Vortex"

                17 - change to "3201 SAM"

18 - change to "1152"

19 - change to "3202 SAM"

20 - change to "3001S HTG"

21 - change to "3095FT"

22 - change to "3095MV"

23 - change to "544 Temp"

24 - change to "644 Temp"

25 - change to "3144 Temp"

26 - change to "3244 Temp"

27 - change to "3700"

28 - change to "3750"

29 - change to " Tri-Loop"

30 - change to "3095C"

31 - change to "3095MM"

32 - change to "3701"

33 - change to "3300"

34 - change to "3702ASU"

35 - change to "2088 Smart"

36 - change to " ProBar"

37 - change to " Mass ProBar"

38 - change to " ProV"

39 - change to "2090 Smart"

40 - change to " ProBar UC"

41 - change to "2055D"

42 - change to "3095PV"

45 - change to " Sentry"

47 - change to " ProPlate UC"

59 - change to " 248 Temperature"

65 - change to " 5600 Radar Level"

Changes to Table 1.42 Siemens Device Type Codes

Enumeration(s) added:
24, 26
Enumeration(s) modified:
2 - changed to " SITRANS L Level"

Changes to Table 1.46 Rosemount Analytical Device Type Codes

Enumeration(s) added:
13, 24, 25, 26, 27, 28, 29, 30
Enumeration(s) modified:
6 - changed to "2081 pH"

7 - changed to "2081 Cond"

10 - changed to "2054 pH"

11- changed to "2054 Cond"

14 - changed to "3081FG"

20 - changed to "3081pH"

21 - changed to "3081C"

80 - changed to "54pH/ORP"

81 - changed to "54eC"

Changes to Table 1.47 Metso Automation Device Type Codes

Enumeration(s) added:
61, 63
Enumeration(s) modified:
None

Changes to Table 1.48 Flowserve Device Type Codes

Enumeration(s) added:
4
Enumeration(s) modified:
3

Changes to Table 1.55 Yokogawa Device Type Codes

Enumeration(s) added:
24, 43, 44, 45, 66, 80, 81, 82
Enumeration(s) modified:
None

Changes to Table 1.62 Smar Device Type Codes

Enumeration(s) added:
none
Enumeration(s) modified:
81 - changed to "LD291"

Changes to Table 1.66 Samson Device Type Codes

Enumeration(s) added:
239
Enumeration(s) modified:
none

Changes to Table 1.69 Krohne Device Type Codes

Enumeration(s) added:
None

Enumeration(s) modified:
230

Changes to Table 1.77 Westlock Device Type Codes

Enumeration(s) added:
4
Enumeration(s) modified:
none

Changes to Table 1.79 Saab Tank Control Device Type Codes

Enumeration(s) added:
237
Enumeration(s) modified:
None

Changes to Table 1.82 Draeger Device Type Codes

Enumeration(s) added:
235
Enumeration(s) modified:
None

Changes to Table 1.87 Metso Automation Device Type Codes

Enumeration(s) added:
235
Enumeration(s) modified:
238, 239

Changes to Table 1.88 Siemens Milltronics PI Device Type Codes

Enumeration(s) added:
202, 205, 206, 207
Enumeration(s) modified:
None

Changes to Table 1.94 Accutech Device Type Codes

Enumeration(s) added:
238
Enumeration(s) modified:
None

Changes to Table 1.97 Knick Device Type Codes

      Enumeration(s) added:
      233
Enumeration(s) modified:
      None

Changes to Table 1.104 Harold Beck and Sons Device Type Codes
Enumeration(s) added:
      10
Enumeration(s) modified:
      None

Changes to Table 1.108 Bopp & Reuther Heinrichs Device Type Codes

      Enumeration(s) added:
      238
Enumeration(s) modified:
      None

Changes to Table 1.114 Dynisco Device Type Codes

      Enumeration(s) added:
      222
Enumeration(s) modified:
      None

Changes to Table 1.140 Magtech Device Type Codes
Enumeration(s) added:
    137
Enumeration(s) modified:
      None

Changes to Table 1.141 Rueger Device Type Codes
Enumeration(s) added:
    127
Enumeration(s) modified:
      None

Changes to Table 1.142 Mettler Toledo Device Type Codes
Enumeration(s) added:
    121
Enumeration(s) modified:
      None

Changes to Table 1.143 Det-Tronics Device Type Codes
Enumeration(s) added:
    124
Enumeration(s) modified:
      None

Changes to Table 1.161 BERTHOLD Device Type Codes
Enumeration(s) added:
    126
Enumeration(s) modified:
      None

Changes to Table 1.169 Invensys Device Type Codes
Enumeration(s) added:

Enumeration(s) modified:
46

Changes to Table 1.171 Tyco Valves & Controls Device Type Codes
Enumeration(s) added:
none
Enumeration(s) modified:
1

Changes to Table 1.174 Tracerco Device Type Codes
Enumeration(s) added:
127
Enumeration(s) modified:
none

Changes to Table 1.195 Lanlian Instruments Device Type Codes
Enumeration(s) added:
none
Enumeration(s) modified:
116 – code changed from "1" to "116"

Changes to Table 1.197 Kajaani Process Measurements Device Type Codes
Enumeration(s) added:
none
Enumeration(s) modified:
128 –changed to "KC/3"

Changes to Table 1.202 Spirax Sarco Italy Device Type Codes
Enumeration(s) added:
128
Enumeration(s) modified:
none

Changes to Table 2.66 Volumetric Flow Unit Codes

Enumeration(s) added:
170, 171, 172, 173, 174, 175,176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186,

187, 188, 189, 190, 250, 252

Enumeration(s) removed:
none
Enumeration(s) modified:
None

Changes to Table 2.68 Volume Unit Code

Enumeration(s) added:
170, 171, 172

Enumeration(s) removed:
none
Enumeration(s) modified:
None

Changes to Table 7. Write Protect Codes

       Enumeration(s) added:
       250, 252, 253

       Enumeration(s) removed:
       none
Enumeration(s) modified:
       None

Changes to Table 8. Manufacturer Identification Codes
Enumeration(s) added:
       200, 201, 202, 203, 204, 205, 206, 207, 208
Enumeration(s) modified
       33 - changed to " PRIME Measurement Products"

       249 – changed to "HART Communication Foundation"

Changes to Table 9. Burst Mode Control Codes

       Enumeration(s) added:
       250, 251, 252, 253

       Enumeration(s) removed:
       none
Enumeration(s) modified:
       None

Changes to Table 16. Loop Current Mode Codes

       Enumeration(s) added:
       None

       Enumeration(s) removed:
       250-253 [1]
Enumeration(s) modified:
       None

Changes to Table 20. Device Variable Family Codes

       Enumeration(s) added:
       8, 9, 10

       Enumeration(s) removed:
       none
Enumeration(s) modified:
       None

Changes to Table 21. Device Variable Classification Codes

Enumeration(s) added:
None

Enumeration(s) removed:
250-253 [1]
Enumeration(s) modified:
None

Changes to Table 22. Trim Point Codes

Enumeration(s) added:
None

Enumeration(s) removed:
250-253 [1]
Enumeration(s) modified:
None

Changes to Table 23. Capture Mode Codes

Enumeration(s) added:
None

Enumeration(s) removed:
250-253 [1]
Enumeration(s) modified:
None

Notes

The use of codes 250-253 was reviewed and rationalized in tables 2, 7-9, 16, and 18-23. In most cases these codes are not applicable to the tables in question.

B.9.　　Modifications from Revision 12.0 to Revision 13.0
The last revision to the document titled: 'HART-Smart Communications Protocol, Common Tables', was HCF_SPEC-183, Revision 12.0. For Revision 13.0, the document tables have been updated to reflect the following changes:

Changes to Table 1. Unique (Rosemount and subsidiaries) Device Type Codes
Renamed – "Device Type Codes"

Added Device Type Code tables
Table 1.03 Ametek Device Type Codes
Table 1.10 Brooks Instrument Device Type Codes
Table 1.14 Delta Device Type Codes
Table 1.17 Endress & Hauser Device Type Codes
Table 1.18 Elsag Bailey Device Type Codes
Table 1.20 Foxboro Device Type Codes
Table 1.21 Fuji Device Type Codes

Table 1.132 Status Instruments Device Type Codes
Table 1.133 Huakong Device Type Codes
Table 1.135 Vortek Instruments, LLC Device Type Codes
Table 1.137 Action Instruments Device Type Codes
Table 1.140 Magtech Device Type Codes
Table 1.141 Rueger Device Type Codes
Table 1.144 TN Technologies Device Type Codes
Table 1.145 Dezurik Device Type Codes
Table 1.147 WELLTECH SHANGHAI Device Type Codes
Table 1.154 Milton Roy Co. Device Type Codes
Table 1.155 PMV Device Type Codes
Table 1.156 Turck Device Type Codes

Added Unit Code Expansion tables
Table 2.1 Temperature Unit Codes
Table 2.2 Pressure Unit Codes
Table 2.3 Volumetric Flow Unit Codes
Table 2.4 Velocity Unit Code
Table 2.5 Volume Unit Code
Table 2.6 Length Unit Code
Table 2.7 Time Unit Code
Table 2.8 Mass Unit Code
Table 2.9 Mass Flow Code
Table 2.10 Mass per Volume Unit Code
Table 2.11 Viscosity Unit Code
Table 2.12 Angular Velocity Unit Code
Table 2.13 Area Unit Code
Table 2.14 Energy (Work) Unit Code
Table 2.15 Force Unit Code
Table 2.16 Power Unit Code
Table 2.17 Frequency Unit Code
Table 2.18 Analytical Unit Code
Table 2.19 Capacitance Unit Code
Table 2.20 EMF Unit Code
Table 2.21 Current Unit Code
Table 2.22 Resistance Unit Code
Table 2.23 Angle Unit Code
Table 2.24 Conductance Unit Code
Table 2.25 Volume per Volume Unit Code
Table 2.26 Volume per Mass Unit Code
Table 2.27 Concentration Unit Code

Added Enhanced Status tables
Table 16. Loop Current Mode Codes
Table 17. Extended Device Status Codes
Table 18. Lock Device Codes

Added Device Variable tables
Table 19. Write Device Variable Command Codes
Table 20. Device Family Support Codes
Table 21. Device Variable Classification Codes

Changes to Table 1a. Rosemount Device Type Codes
Table re-sequenced:
        "1a " changed to "1.38"
Enumeration(s) added:
        47
Enumerations(s) modified:
        None

Changes to Table 1b. Rosemount Analytical Device Type Codes
Table re-sequenced:
    "1b" changed to "1.46"
Enumeration(s) added:
    None
Enumerations(s) modified:
    None

Changes to Table 1c. KayRay Device Type Codes
Table re-sequenced:
    "1c " changed to "1.25"
Enumeration(s) added:
    None
Enumerations(s) modified:
    None

Changes to Table 1d. Micro Motion Device Type Codes
Table re-sequenced:
    "1c " changed to "1.31"
Enumeration(s) added:

Changes to Table 8. Manufacturer Identification Codes
Enumeration(s) added:
    141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154
Enumeration(s) modified
    22 - changed to "ABB Automation"
    26 - changed to "ABB Automation"
    121- changed to "AALIANT Process Mgt"

APPENDIX A: Unique (Rosemount and Subsidiaries) Device Type Codes
Deleted

APPENDIX B: Device Description language file
Deleted

B.10.   Modifications from Revision 11.0 to Revision 12.0

The last revision to the document titled: 'HART-Smart Communications Protocol, Common Tables', was HCF_SPEC-183, Revision 11.0. For Revision 12.0, the document tables have been updated to reflect the following changes:

Changes to Table 8. Manufacturer Identification Codes
Enumeration(s) added:
    141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 160, 161,

162, 163

B.11.   Modifications from Revision 10.0 to Revision 11.0

The last revision to the document titled: 'HART-Smart Communications Protocol, Common Tables', was HCF_SPEC-183, Revision 10.0. For Revision 11.0, the document tables have been updated to reflect the following changes:

Changes to Table 1a. Rosemount Device Type Codes.
Enumeration(s) added:
    40, 41, 42, 45

Changes to Table 2. Unit Codes.
Enumeration(s) added:
    145, 146, 147, 148, 149, 154, 155, 161, 169

Enumerations(s) modified:
      None

Changes to Table 3. Transfer Function Codes.
Enumeration(s) added:
      230
Enumerations(s) modified:
      None

Changes to Table 4. Material Codes.
Enumeration(s) added:
      38
Enumerations(s) modified:
      None

Changes to Table 8. Manufacturer Identification Codes
Enumeration(s) added:
      114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130,

          131, 132, 133, 134, 135, 136, 137, 138, 139, 140
Enumeration(s) modified
      43 - changed to "Weed"
      48 - changed to "Flowserve"
      51 - changed to "Delta/Weed"
      59 – changed to "Meggitt Mobrey"

B.12.　　Modifications from Revision 9.0 to Revision 10.0

The last revision to the document titled: 'HART-Smart Communications Protocol, Common Tables', was HCF_SPEC-183, Revision 9.0. For Revision 10.0, the document has been formatted for ease of use. In addition to formatting, the document tables have been updated to reflect the following changes:

Changes to Table 1a. Rosemount Device Type Codes.
Enumeration(s) added:
      35, 36, 38, 39

Changes to Table 2. Unit Codes.
Enumeration(s) added:
      144
Enumerations(s) modified:
      None

Changes to Table 8. Manufacturer Identification Codes
Enumeration(s) added:
      79, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113
Enumeration(s) modified
      5, 18, 22 - changed to "Elsag Bailey"
      63 - changed to "FOXBORO ECKARDT"
      87 - changed to "Neles Controls"