TEST SPECIFICATION

FIELDCOMM GROUP™

Connecting the World of Process Automation

HART® COMMUNICATION PROTOCOL

Common Practice Command Test Specification

HCF_TEST-004, FCG TT20004
Revision 8.0

Release Date: 12 October 2024

Release Date: 12 October 2024

Document Distribution / Maintenance Control / Document Approval
To obtain information concerning document distribution control, maintenance control and document approval, please contact the FieldComm Group at the address shown below.

Copyright © 2000, 2002, 2004, 2009, 2018, 2020, 2021, 2023, 2024 FieldComm Group
This document contains copyrighted material and may not be reproduced in any fashion without the written permission of the FieldComm Group.

Trademark Information
HART® and WirelessHART® are registered trademarks of the FieldComm Group, Austin, Texas, USA. Any use of the term HART or WirelessHART hereafter in this document, or in any document referenced by this document, implies the registered trademark. All other trademarks used in this or referenced documents are trademarks of their respective companies. For more information contact the FieldComm Group Staff at the address below.

FIELDCOMM GROUP™
Connecting the World of Process Automation

FieldComm Group
9430 Research Boulevard
Suite 1-120
Austin, TX 78759, USA

Voice: +1 512-792-2300
FAX: 1-512-792-2310

http://www.fieldcommgroup.org

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 Client functionality and, when this is the case, does not imply the function is optional in Field Devices.

Intellectual Property Rights
The FieldComm Group does not knowingly use or incorporate any information or data into the HART Specifications which the FieldComm Group does not own or have lawful rights to use. Should the FieldComm Group receive any notification regarding the existence of any conflicting Private IPR, the FieldComm Group will review the disclosure and either (a) determine there is no conflict; (b) resolve the conflict with the IPR owner; or (c) modify this specification to remove the conflicting requirement. In no case does the FieldComm Group encourage implementers to infringe on any individual's or organization's IPR.

Table of Contents

Preface 7
Introduction 8
1. Scope 10
1.1 Features Tested 10
1.2 Features Not Tested 10
2. Approach 10
2.1 Testing Sequence 12
2.2 Conventions 13
2.3 Burst Mode Services 14
2.4 Comparing Floating-Point Numbers 15
3. Test Definitions 16
3.1 CAL000 Check for Common Practice Commands 16
3.2 CAL001 Verify Write Protect 19
3.3 CAL033 Read Device Variables 42
3.4 CAL034 Write Primary Variable Damping Value 44
3.5 CAL035 Write Primary Variable Range Values 48
3.6 CAL036 Set Primary Variable Upper Range Value 54
3.7 CAL037 Set Primary Variable Lower Range Value 57
3.8 CAL040 Enter/Exit Fixed Current Mode 60
3.9 CAL041 Perform Self Test 64
3.10 CAL043 Set Primary Variable Zero 65
3.11 CAL044 Write Primary Variable Units 67
3.12 CAL045 Trim Loop Current Zero 70
3.13 CAL046 Trim Loop Current Gain 73
3.14 CAL047 Write Primary Variable Transfer Function 76
3.15 CAL049 Write Primary Variable Transducer Serial Number 78
3.16 CAL050 Read Dynamic Variable Assignments 80
3.17 CAL051 Write Dynamic Variable Assignments 81
3.18 CAL052 Set Device Variable Zero 85
3.19 CAL053 Write Device Variable Units 88
3.20 CAL054 Read Device Variable Information 91
3.21 CAL055 Write Device Variable Damping Value 92
3.22 CAL056 Write Device Variable Transducer Serial Number 96
3.23 CAL060 Read Analog Channel And Percent Of Range 98
3.24 CAL062 Read Analog Channels 99
3.25 CAL063 Read Analog Channel Information 100
3.26 CAL064 Write Analog Channel Additional Damping Value 101
3.27 CAL065 Write Analog Channel Range Values 105
3.28 CAL066 Enter/Exit Fixed Analog Channel Mode 112
3.29 CAL067 Trim Analog Channel Zero 115

3.30 CAL068 Trim Analog Channel Gain 119
3.31 CAL069 Write Analog Channel Transfer Function 122
3.32 CAL070 Read Analog Channel Endpoint Values 125
3.33 CAL071 Lock Device 126
3.34 CAL072 Squawk 132
3.35 CAL073 Find Device 135
3.36 CAL074 Verify I/O System Commands 137
3.37 CAL078 Command Aggregation 149
3.38 CAL079 Write Device Variable 152
3.39 CAL080 Verify Device Variable Trim Commands 155
3.40 CAL091 Trending 161
3.41 CAL101 I/O Subsystem Burst Mode 171
3.42 CAL103 Support for Multiple Burst Messages 178
3.43 CAL104 Smart Data Publishing 187
3.44 CAL107 Write Burst Device Variables 194
3.45 CAL108 Write Burst Mode Command Number 198
3.46 CAL109 Burst Mode Control 203
3.47 CAL115 Event Notification 207
3.48 CAL512 Country Code 217
3.49 CAL518 Location Description 219
3.50 CAL520 Process Unit Tag 222
3.51 CAL523 Read Condensed Status Mapping Array 226
3.52 CAL524 Manipulating Condensed Status Map 236
3.53 CAL526 Status Simulation 248
3.54 CAL532 Client Subscriptions 262
3.55 CAL538 Writing Supplemental IP Ports 271
3.56 CAL541 Managing Security Credentials 278
3.57 CAL543 syslog Server identity and port. 302
3.58 CAL548 Digital Write Protect 309
3.59 CAL552 DiffServ 319

ANNEX A. Reusable Test Procedure Definitions 322
A.1 CheckCommandImplemented (Cmd) 322
A.2 CheckBurstCommands ( ) 322
A.3 CheckForCommand (Cmd) 323
A.4 CheckForRecommendedCommand (Cmd) 323
A.5 CheckReadyForBurst ( ) 323
A.6 CompareAnalogChannelValue (aChan, aValue, fp) 325
A.7 CyclePower ( ) 325
A.8 DisableBurstMode (bMsg) 326
A.9 EnableBurstMode (bMsg) 326
A.10 FindNextAnalogChannel (aChan) 327
A.11 FindNextDeviceVariable (dVar) 328
A.12 IdentifyDevice ( ) 330

A.13 IssueCommand103 (bmsg, period, maxperiod, fp) 331
A.14 IssueCommand104 (bmsg, trigger, classification, units, value, fp) 331
A.15 IssueCommand109 (bMsg, bCtrl) 332
A.16 IssueCommand524 (index, noEntries, mappingCodes [ ]) 332
A.17 IssueCommand525 ( ) 333
A.18 IssueCommand526 (modeCode) 333
A.19 IssueCommand527 (bitNo, simVal) 334
A.20 OnlyFSet (fp) 334
A.21 OnlyCSet (fp) 335
A.22 OnlySSet (fp) 335
A.23 OnlyMSet (fp) 336
A.24 ReadCondensedStatusMap (StatusMap [ ]) 336
A.25 ReadPV () 337
A.26 TestValidFrame ( ) 337
A.27 ValidateLongTag (lTag, cfgCntr, fp) 337
A.28 ValidateLoopCurrent () 338
A.29 VerifyAssociatedCommands (Cmd[0], Cmd[1], Cmd[2]…) 338
A.30 VerifyLoopCurrent (v, fp) 338
A.31 VerifyNotLocked () 339
A.32 VerifyNotWriteProtected () 339
A.33 VerifyRange(lrv, urv, units, fp) 340
A.34 VerifyRangeAndPV (lrv, urv, units, PV, fp) 341
A.35 VerifyResponseAndByteCount (r, b) 341
A.36 VerifyResponseAndByteCount (r[ ], b) 342

ANNEX B. Failure Point Cross Reference 343

ANNEX C. References 349
C.1 The HART-Field Communications Protocol Specifications 349
C.2 Other FieldComm Group Documents 349
C.3 Related Documents 349

ANNEX D. Definitions 350

ANNEX E. Symbols/Abbreviations 351

ANNEX F. Revision History 352
F.1 Revision 8.0 352
F.2 Revision 7.0 353
F.3 Revision 6.1 353
F.4 Revision 6.0 353
F.5 Revision 5.0 354
F.6 Revision 4.0 355
F.7 Revision 3.0 356
F.8 Revision 2.0 356

Index to Tables

Table 1 Test Execution Sequence 12
Table 2 Common Response Codes 13
Table 3 Burst Mode Services 14
Table 4 Test Coverage of Burst Mode Commands 14
Table 5 Test Vectors for Scan of Common Practice Commands 16
Table 6 Simple Write Protect Test Cases 20
Table 7 Write Protect Test Cases for Device Variables 31
Table 8 Write Protect Test Cases for Analog Channels 36
Table 9 Command 34: Damping Value Test Cases 44
Table 10 Command 35: Set Range Values Test Cases 49
Table 11 Command 36 Test Cases 54
Table 12 Command 37 Test Cases 57
Table 13 Command 40 Test Cases 60
Table 14 Command 45 Test Cases 70
Table 15 Command 46 Test Cases 73
Table 16 Command 55: Damping Value Test Cases 92
Table 17 Command 64: Damping Value Test Cases 101
Table 18 Command 65: Set Range Values Test Cases 106
Table 19 Command 66 Test Cases 112
Table 20 Command 67 Test Cases 115
Table 21 Command 68 Test Cases 119
Table 22 Basic Command 71 Test Cases 126
Table 23 Command 71 Test Cases Performed for Each Master 126
Table 24. Test Vectors for CAL523 (Test Case B) 228
Table 25. Test Vectors for CAL524 (Test Case C) 242
Table 26 Test Vectors for Command 541 279
Table 27 Test Vectors for Command 542 280
Table 28 Users and lock codes 309
Table 29 Command 549 Response Code Testing 310
Table 30 Command 550 Response Code Testing 310
Table 31 DSCP Values expected in ToS 320
Table 32 Burst Mode Command Requirements 322