Iceland Technical Support Training

Contents

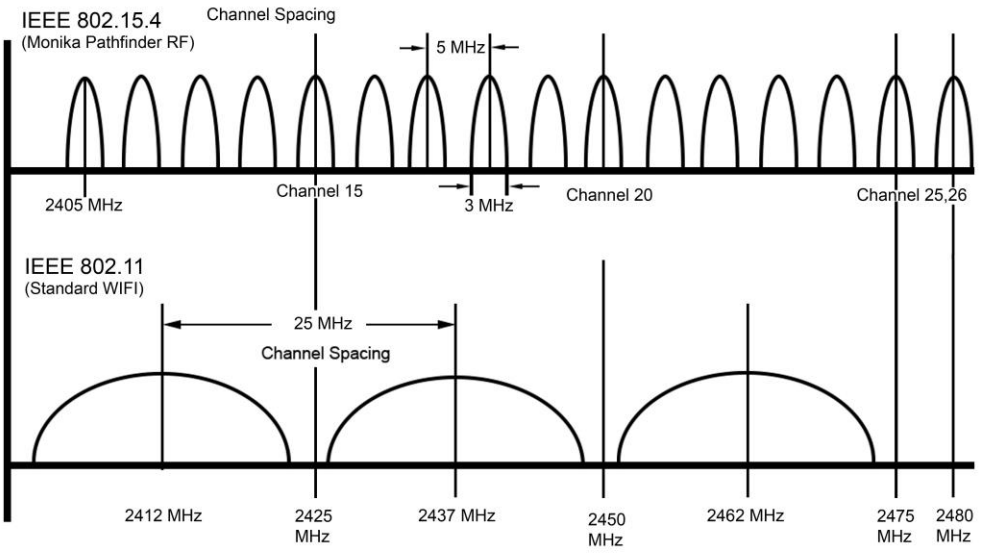
PathFinder Overview

Monika PathFinder is a ZigBee based technology, compliant with the internationally recognised IEEE802.15.4 standard which forms part of the IEEE 802 range of harmonised standards covering, amongst others, wireless networks. This ensures its safe co-existence with other RF technologies within the scope of the standards, most notably 802.11b/g; wireless LAN or 'WiFi'.

This is meshed network technology that provide a robust, self healing network by virtue of nodes on the network to route data back to the central point, thus not relying on single one-to-one connections that may become severed.

A typical connectivity schematic for a Pathfinder system is shown below.

COMPARISION OF MONIKA PATHFINDER RF
& STANDARD WIRELESS LAN (WIFI) CHANNEL FREQUENCIES



TE-D2028 - ICT PACK - FIG 3 - 12/02/2017

Concept of PANs and Channels and Sinks

PathFinder uses a concept of PANs (Personal Area Network) and channels to identify and separate networks.

Each PAN comprises a number of nodes, and a Sink. A node is any piece of PathFinder equipment on the network and the Sink is a specific type of node that is the central recipient of data sent over the network.

In the context of Iceland stores there is only ever a single network, where the slaves are the majority of the nodes and the NMU is the Sink.
For simplicity all stores use the same PAN and channel configuration; channel 26 and PAN ID 1111. This allows equipment to be pre-configured and sent to site for installation without a PC.

PathFinder Variants

Due to the evolution of the ZigBee standard, there are two variants of PathFinder on the Iceland estate; PF3 and PF4. These operate using exactly the same principles but the hardware cannot be mixed and slightly different commands are used to administer the networks.

So it is important when working on PathFinder systems to identify which version you are dealing with.

You can check the slave setup on the PC, or the label on a slave, to check the network type. In general systems installed after December 2013 will be PF4.

There are three basic versions of slave used throughout the estate, each with a High Performance variant. These are summarised below.

Slave Type	Network Type
ETRX2	PF3
ETRX2 High Performance	
PF3	
PF3 High Performance	
PF4	PF4
PF4 High Performance	

Compatibility of PF3 and PF4 Equipment

Generally PF3 and PF4 equipment cannot be mixed within a network and network components should be replaced like-for-like. PF3 equipment can have its firmware reflashed to allow it to operate with PF4 networks. However this is not generally considered normal practice and reserved for exceptional circumstances. Should such a situation arise then Monika Technical Support should be contacted for guidance.

AT Commands

All PathFinder devices are configured and managed using a collection of AT commands (similar to modems and other serial devices) These can be sent over the RF network via the dongle, or by a direct connection to a Monika Interface Unit. In both cases Telegesis Terminal is used to send the AT commands.

It is only necessary to know a few key commands for configuration and diagnostic purposes.

Command	Function	Response	Description	
AT	Attention!	OK	Acknowledgement that the dongle is connected	
ATI	Device Info		Returns the ID and firmware version of the dongle.	
AT+N	Network Info		Returns the Channel and PAN ID of the current network	
AT+JN	Join PAN		Dongle will join the network determined by its PAN and channel mask setting.	
AT+SN	Scan the PAN		Dongle will scan for nodes and produce a list of any found	
AT+PANSCAN	Scan for visible PANs		Dongle will scan the airwaves for PANs and produce a list of any found.	
ATS0O	Set or read S Register 00			
ATS01	Set or Read S Register 01			
ATS02	Set or Read S Register 02			

S Registers

The behaviour of all PathFinder devices is controlled and determined by the settings of internal memory locations known as ‘S Registers’. There is a multitude of these but it is only necessary to understand the few that relate to functionality within a Monika environment.

The key S Registers to know are the two that control the channel and PAN configuration as these are used extensively in managing how slaves, repeaters and the NMU interact with the network, and most problems are resolved (and caused!) using these registers.

Note that there are different S Registers for these functions depending on the network type.

	S Register		
Function	**PF3 Network**	**PF4 Network**	
Channel Mask	00	00	See Appendix B
PAN ID Mask	01	02	

Decimal and Hexadecimal Notation

Note that all Telegesis AT commans use hexadecimal notation.

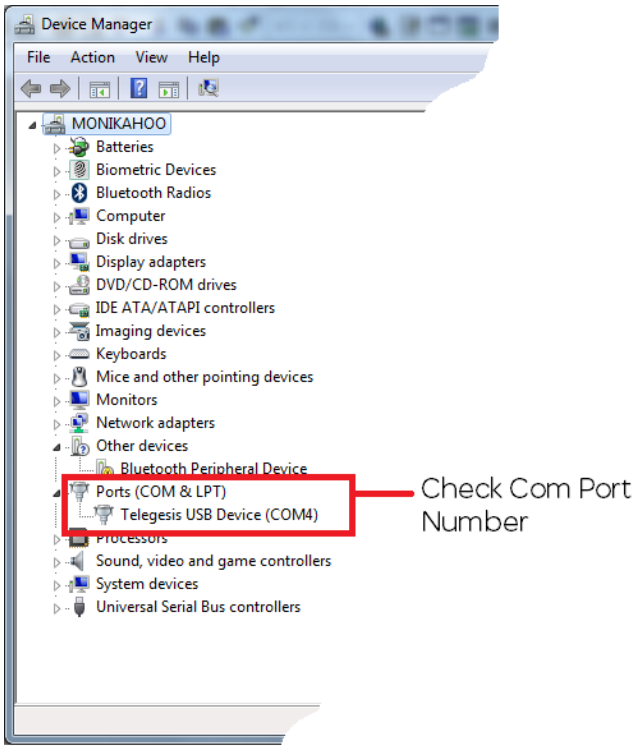
Administering Pathfinder Network

Administering PathFinder networks is generally performed using a laptop and PathFinder dongle, and Telegesis Terminal software.

Starting and Testing Telegesis Terminal

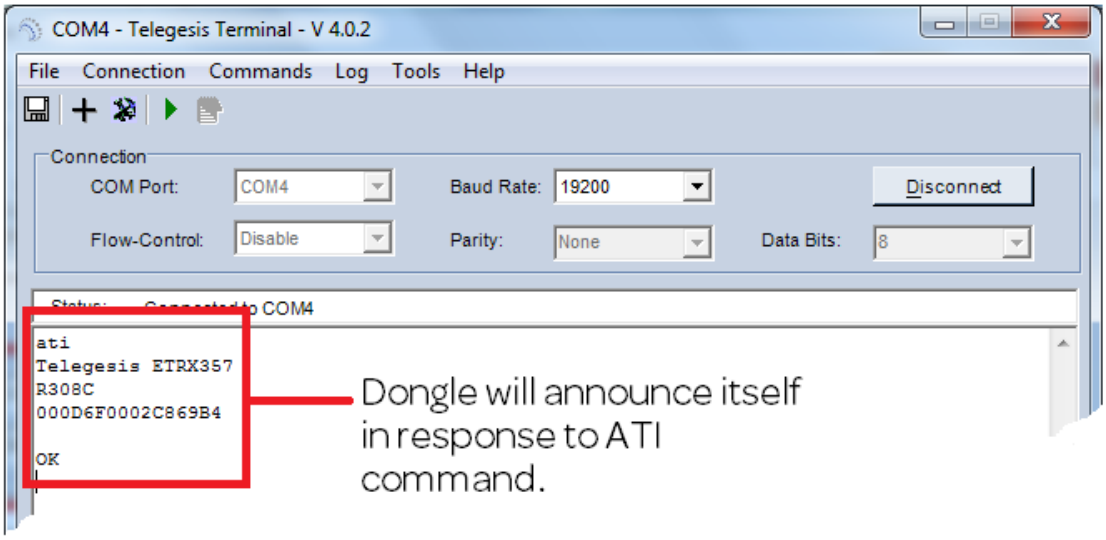
1. Plug the PathFinder dongle to a USB port on the laptop. It is recommended that the same USB port is used each time as this will ensure that the Device Manager enumerates the dongle to the same COM port number as the previous session.
2. Open Telegesis Terminal then check that the com port settings are correct. These should be as shown below, but the COM port number may be different for your PC.

   If you don't know which COM port the dongle as been assigned to then check the Windows Device Manger under 'Ports (COM & LPT)' where you should see the allocated COM port.



Once the settings are correct click the 'Connect' button.

4. Now test the connection to the dongle by typing 'ATI' in the terminal window, and check that the dongle announces itself.



5. You are now ready to use the system.

Using Telegesis Terminal

Telegesis Terminal allows you to send comm

Configuring the Dongle for Iceland Networks

By default Iceland networks are all configured with a PAN ID of 1111, and are usually on channel 26, but this cannot be guaranteed. Therefore it is best to configure the dongle such that it can see ANY PAN on ANY channel.

The PAN ID is controlled through S Register 02 and the Channel is controlled through S

ATS00=FFFF
ATS02=1111

Scanning for PANs

It is often useful to scan the network to check that there is only a single PAN, and that it has the expected 1111 PAN ID.

Joining a PAN

In order to administer any devices on it on a PAN, you must first join it. You may find that the dongle has already joined the store's PAN as by default it will attempt

to join the nearest PAN. You can check this clicking the 'Network Info' button or by typing:

AT+N

This will show you the PAN you are currently joined to.

at+n

+N=FFD,25,03,AAAA,EF47FD9C334EA4DC

OK

If you are not joined to a PAN then the command will return:

NoPan

OK

If only a single PAN exists you can join it by simply typing AT+JN to join any PAN and the dongle will join the only existing PAN. As a rule the AT+JN command makes the device join the any available PAN with the lowest channel number e.g. if 19,2222 and 26,1111 PANs exist, the device will attempt to join 19,2222.

Scanning for Slaves

AT+SN

Creating a PAN

AT+EN

Diagnostics and Fault Finding

Symptom	Possible Causes	Checks		
All cabinets Non-comms	NMU is no longer the Sink	Scan for PANs and check that a network exists.		
One cabinet non-comms	Slave has lost power	Check slave supply.		
	Slave is not on the network	Join PAN and scan for slaves		
	Slave registers incorrect			
	Slave is on a different PAN to others	Scan for PANs and check that only a single PAN exists.		
	Slave is out of range of network	From the NMU location, join the store PAN and scan for slaves. If slave cannot be found, go to slave location and rescan. If slave is found then there is poor RF connectivity between slave and network.		

Common Issues

Orphaned Slaves
Site configured with incorrect PAN
Duplicate PANs.
Incorrect slave type causing temperature anomalies.

Recovering Pathfinder Equipment

In the course of service work there may be occasions where Pathfinder equipment is encountered that is an unknown state and will not join the network. The usual cause of this will be that the S Register configuration has been incorrectly set or not known. Equipment in this state can usually be recovered by connecting directly to the internal module wit the Monika Interface Unit.

Using The Monika Interface Unit

Appendix A

Full List of AT Command Error Codes

00	Everything OK - Success
01	Couldn't poll Parent because of Timeout
02	Unknown command
04	Invalid S-Register
05	Invalid parameter
06	Recipient could not be reached
07	Message was not acknowledged
08	No sink known
09	Address Table entry is in use and cannot be modified
0A	Message could not be sent
0B	Local node is not sink
0C	Too many characters
0E	Background Scan in Progress (Please wait and try again)
0F	Fatal error initialising the network
10	Error bootloading
12	Fatal error initialising the stack
18	Node has run out of Buffers
19	Trying to write read-only register
1A	Data Mode Refused by Remote Node
1B	Connection Lost in Data Mode
1C	Remote node is already in Data Mode
20	Invalid password
25	Cannot form network
27	No network found
28	Operation cannot be completed if node is part of a PAN
2C	Error leaving the PAN
2D	Error scanning for PANs
33	No response from the remote bootloader
34	Target did not respond during cloning
35	Timeout occurred during xCASTB
39	MAC Transmit Queue is Full
6C	Invalid Binding Index
70	Invalid Operation
72	More than 10 unicast messages were in flight at the same time
74	Message too long
80	ZDP Invalid Request Type
81	ZDP Device not Found
82	ZDP Invalid Endpoint
83	ZDP Not Active

84	ZDP Not Supported
85	ZDP Timeout
86	ZDP No Match
87	ZDP Table Full
88	ZDP No Entry
89	ZDP No Descriptor
91	Operation only possible if connected to a PAN
93	Node is not part of a Network
94	Cannot join network
96	Mobile End Device Move to new Parent Failed
98	Cannot join ZigBee 2006 Network as Router
A1	More than 8 broadcasts were sent within 8 seconds
AB	Trying to join, but no beacons could be heard
AC	Network key was sent in the clear when trying to join secured
AD	Did not receive Network Key
AE	No Link Key received
AF	Preconfigured Key Required
C5	NWK Already Present
C7	NWK Table Full
C8	NWK Unknown Device

Appendix B

Summary of S Register 00 And Associated Channel Numbers

Channel 26 = 8000
Channel 25 = 4000
Channel 24 = 2000
Channel 23 = 1000
Channel 22 = 0800
Channel 21 = 0400
Channel 20 = 0200
Channel 19 = 0100
Channel 18 = 0080
Channel 17 = 0040
Channel 17 = 0020
Channel 15 = 0010
Channel 14 = 0008
Channel 13 = 0004
Channel 12 = 0002
Channel 11 = 0001

Appendix C

Denary To Hexadecimal Conversion Table

Denary	Hex	Denary	Hex	Denary	Hex	Denary	Hex	Denary	Hex	Denary	Hex
01	1	51	33	101	65	151	97	201	C9	251	FB
02	2	52	34	102	66	152	98	202	CA	252	FC
03	3	53	35	103	67	153	99	203	CB	253	FD
04	4	54	36	104	68	154	9A	204	CC	254	FE
05	5	55	37	105	69	155	9B	205	CD	255	FF
06	6	56	38	106	6A	156	9C	206	CE	256	100
07	7	57	39	107	6B	157	9D	207	CF	257	101
08	8	58	3A	108	6C	158	9E	208	D0	258	102
09	9	59	3B	109	6D	159	9F	209	D1	259	103
10	A	60	3C	110	6E	160	A0	210	D2	260	104
11	B	61	3D	111	6F	161	A1	211	D3	261	105
12	C	62	3E	112	70	162	A2	212	D4	262	106
13	D	63	3F	113	71	163	A3	213	D5	263	107
14	E	64	40	114	72	164	A4	214	D6	264	108
15	F	65	41	115	73	165	A5	215	D7	265	109
16	10	66	42	116	74	166	A6	216	D8	266	10A
17	11	67	43	117	75	167	A7	217	D9	267	10B
18	12	68	44	118	76	168	A8	218	DA	268	10C
19	13	69	45	119	77	169	A9	219	DB	269	10D
20	14	70	46	120	78	170	AA	220	DC	270	10E
21	15	71	47	121	79	171	AB	221	DD	271	10F
22	16	72	48	122	7A	172	AC	222	DE	272	110
23	17	73	49	123	7B	173	AD	223	DF	273	111
24	18	74	4A	124	7C	174	AE	224	E0	274	112
25	19	75	4B	125	7D	175	AF	225	E1	275	113
26	1A	76	4C	126	7E	176	B0	226	E2	276	114
27	1B	77	4D	127	7F	177	B1	227	E3	277	115
28	1C	78	4E	128	80	178	B2	228	E4	278	116
29	1D	79	4F	129	81	179	B3	229	E5	279	117
30	1E	80	50	130	82	180	B4	230	E6	280	118
31	1F	81	51	131	83	181	B5	231	E7	281	119
32	20	82	52	132	84	182	B6	232	E8	282	11A
33	21	83	53	133	85	183	B7	233	E9	283	11B
34	22	84	54	134	86	184	B8	234	EA	284	11C
35	23	85	55	135	87	185	B9	235	EB	285	11D
36	24	86	56	136	88	186	BA	236	EC	286	11E
37	25	87	57	137	89	187	BB	237	ED	287	11F
38	26	88	58	138	8A	188	BC	238	EE	288	120
39	27	89	59	139	8B	189	BD	239	EF	289	121
40	28	90	5A	140	8C	190	BE	240	F0	290	122
41	29	91	5B	141	8D	191	BF	241	F1	291	123
42	2A	92	5C	142	8E	192	C0	242	F2	292	124
43	2B	93	5D	143	8F	193	C1	243	F3	293	125
44	2C	94	5E	144	90	194	C2	244	F4	294	126
45	2D	95	5F	145	91	195	C3	245	F5	295	127
46	2E	96	60	146	92	196	C4	246	F6	296	128
47	2F	97	61	147	93	197	C5	247	F7	297	129
48	30	98	62	148	94	198	C6	248	F8	298	12A
49	31	99	63	149	95	199	C7	249	F9	299	12B
50	32	100	64	150	96	200	C8	250	FA	300	12C

Appendix D

Monika Equipment Behaviour Summary

Slave Behaviour

When powered a slave will attempt to join a PAN based on its channel and PAN ID masks. Once joined to a PAN it will then begin sending temperature data to the Sink at regular intervals.

NMU Behaviour

When powered an NMU will attempt to join a PAN based on its channel and PAN ID masks. And establish itself as the Sink. It will then receive any data from Slaves, as well as acting as an additional node on the network.

Repeater Behaviour

When powered a Repeater will attempt to join a PAN based on its channel and PAN ID masks. Following this it will remain on the network and act as an additional node on the network, improving robustness.