

BlueBird Cellular Modem
Users' Manual

Version 1.2

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1 Introduction

Blue Tree Wireless Data's **BLUEBIRD** Modem is a compact cellular-based modem designed to improve the quality and reliability of data communications over the existing analog cellular network (AMPS). Its robust features optimize data throughput (14.4Kbps), and support the industry standard MNP10 for enhanced cellular performance.

The **BLUEBIRD** ruggedized construction is ideal for commercial and industrial applications such as: sign control, point of sale terminals, data acquisition, and many more.

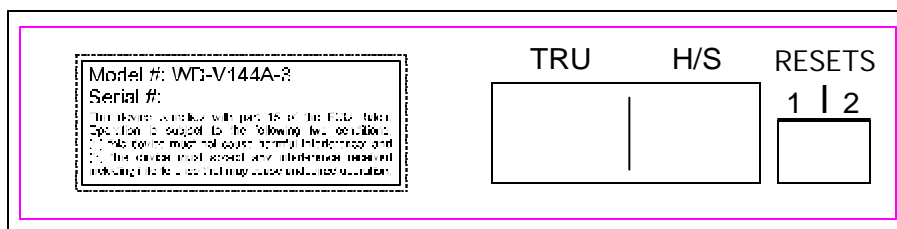
2 Product Overview

The **BLUEBIRD** is a complete 14.4 Kbps modem AND a Group III send and receive fax. It's operated by AT commands set, the most used standard for DTE (Data terminal Equipment)/ DCE (Data Communication Equipment) communications. In DTE mode, the **BLUEBIRD** has a maximum throughput of 57.6Kbps.

Figure 1 BLUEBIRD front view



Figure 2 BLUEBIRD back view



2.1 Power Switch

The **BLUEBIRD** may come with an optional external switch to enable the modem ("1") or to shut it OFF ("0"). Versions without a power switch are always ON unless the cellular phone's power supply is removed.

2.2 Light Emitting Diodes

On the front plate of the modem, four red LEDs are displayed: DTR, TX, RX and CD from left to right. There is also a multi-colored LED for power/modem status. Those five indicators offer a user-friendly means of inquiring the modem's operating status. They are described in the table below.

Table 1 LED indicators

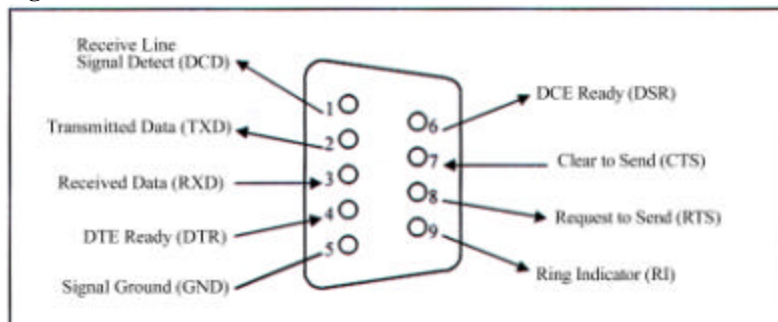
LED	Description	Color	Corresponding position
DTR	Data Terminal Ready	R	In operation
TX	Transmit Data	R	In operation
RX	Receive Data	R	In operation
CD	Carrier Detect	R	In operation
PWR/STAT	Power and phone status	G	In service
		GF	Modem in use OR handset in use
		G/RI	Incoming call
		GF/RI	Relief procedure
		O	Low Battery AND in service
		OF	Low battery AND modem in use OR handset in use
		O/RI	Low battery AND incoming call
		OF/RI	Low battery AND relief procedure
		R	Out of service OR fast busy
		RF	Locked OR no connection between cellular and modem

G= green	GF – Flashing green
R= red	RF – Flashing red
O= orange	OF – Flashing orange
	/RI = Ring indicator (G, R, G, R, G, R...)

2.3 RS232 Host Interface

As shown in the figure above, the **BLUEBIRD** is equipped with one serial host interface: a DB-9 female connector.

Figure 3 DB9 connector



2.4 Transceiver and Handset Input

On the back plate of the modem, two RJ45 connectors allow a direct connection to both the transceiver and the handset.

3 Technical Overview

3.1 Flow Control

The modem supports two methods of flow control: XON/XOFF (or software) flow control and RTS/CTS (or hardware) flow control. Both methods hold the flow of data between the modem and the local DTE until the receiving equipment is ready to accept further data.

RTS/CTS is the default and preferred method of flow control. It operates by controlling the RTS (ready to send) and CTS (clear to send) lines on the RS232 interface. To function properly, these control lines must be connected between the modem and the DTE by an appropriate cable.

3.2 Error Correction

Table 2 Error correction

V.42	Error correction, using HDLC with 16/32 bit CRC. Also called "LAPM" (Link Access Procedure for Modems)
MNP2-4	Microcom's error correction protocol
MNP10	for Adverse Channel Enhancement
MNP10EC	for enhance analog cellular performance

3.3 Data Compression

Table 3 Data compression

V.42bis	Data compression, using "variable-length to fixed-length" block coding (codeword size constant)
MNP5	Proprietary data compression standard of Microcom. Using "run length encoding" and "adaptive frequency encoding" (codeword size varies)

3.4 Modulation Techniques

The **BLUEBIRD** supports all the modulation protocols in the table below. The choice of the protocol dictates the line speed of the communication. These speeds may be selected individually via the setting of the S37 Register, but it is more commonplace to enable auto-mode to allow the modem and remote system to determine the speed they use to talk to each other.

Table 4 Modulation Techniques

V.32bis	4800 - 14400 bps modem standard
V.32	4800 and 9600 bps modem standard
V.22bis	2400 bps modem standard
V.22	1200 bps modem standard
V.21	300 bps modem standard
Bell 212A	1200 bps modem US standard
Bell 103	300 bps modem US standard

3.5 Standard Configurations

The **BLUEBIRD** is configured using the “HyperTerminal” tool available by default on any PC; one has to connect the modem directly into the COM port of the PC through a 9-pin serial cable. Blue Tree’s standard configuration is as follows¹:

Table 5 Blue Tree’s basic configuration of the BLUEBIRD

&F0	Restore factory configuration 0
)M1	Enable MNP10 link negotiation power adjustment
*H1	Select MNP10 negotiation at 1200 bps
@M18	Select initial transmit level of -18 dBm
:E0	Disable the compromise equalizer
\N5	Force MNP mode
S10=150	Delay to hang-up when loss of carrier
S0=1	Auto-answer after one ring
&W0	Store the active profile in NVRAM profile 0

Note: the modem communicating with the BLUEBIRD should also be configured in the same manner as above!

¹ All commands should be preceded by “AT”.

3.6 Features

3.6.1 Sleep Mode

The Sleep Inactivity Timer of the modem (S24) sets the length of time, in seconds, that the modem will operate in normal mode with no detected telephone line or DTE line activity before entering low-power sleep mode. The timer is reset upon any DTE line or telephone line activity. If the S24 value is zero, the modem will not enter sleep mode, even if there is no DTE line or telephone activity.

Range: 0-255 seconds

Default: 0

3.6.2 Auto Power-on

When the transceiver is turned OFF, manually or due to power source variations, the **BLUEBIRD** automatically reactivates it and puts it back in operating mode.

3.6.3 Auto Unlock

If the user accidentally locks the telephone (transceiver), or if it is configured in mobile mode or auto-lock mode, the **BLUEBIRD** will automatically unlock the telephone to ensure that it is able to generate and answer calls. A jumper enables this feature.

3.6.4 Forward Procedure

When the user receives a call with the handset, he can answer it by pushing the SEND key of the handset. If the call is for the modem, the user can forward the call to the **BLUEBIRD**, by using the #0* keys on his handset.

3.6.5 Call Process Management

When the DTE (equipment that the **BLUEBIRD** is attached to) tries to call, the cellular network may be over capacity or interference may cause calls failures. The **BLUEBIRD** recognizes these problems and in less than 2 seconds, and an auto retry feature restarts calling. A regular modem does not recognize FAST BUSY or NO SVC signals and will wait 50 seconds (S7 register time-out) before returning "NO CARRIER".

Also, after dialing the number, the Motorola interface generates a 5 seconds delay before placing the call. The **BLUEBIRD** originates the call in 0.75 second after the last DTMF digit has been dialed. All status of the cellular transceiver can be seen on LED "PWR/Status" of the **BLUEBIRD** (NO SVC, FAST BUSY, IN USE, LOW BATT, LOCKED, etc.).

3.6.6 Remote Control Resets

The system may not answer if there is a lost DTR signal from the **BLUEBIRD** or any other reason. The **BLUEBIRD** will automatically answer the call after 10 rings. The user at the other end can easily send DTMF tones to generate a reset of the transceiver, the **BLUEBIRD**, or any other peripherals and system connected to one of the two modem's isolated external reset outputs.

Table 6 Commands for remote reset

DTMF command	Function	Characteristics
# 1	External reset I/O # 1 'photo-MOS relay' isolated 120mA max @ 50Vdc, Ron = 35 Ohms	Reactivated for 2 sec each time this command is received. Output type: Normally open contact (N/O)
# 2	External reset I/O # 2 'photo-MOS relay' isolated 120mA max @ 50Vdc, Ron = 35 Ohms	Reactivated for 2 sec each time this command is received. Output type: Normally open contact (N/O)
# 3	Modem reset	Reinitialize the modem's chipset. The call is dropped (modem toggles back to on-hook state).
# 4	External resets I/O #1-2 and modem reset	Activation of the 2 external resets for 2 sec then reset of the modem's chipset. The call is dropped (modem toggles back to on-hook state).
# 5	External resets I/O #1-2 and modem reset and cellular transceiver reset	Same as # 4 then power OFF and ON of the transceiver. The call is dropped.
# *	Modem and cellular transceiver resets	Same as # 3 then power OFF and ON of the transceiver. The call is dropped.

A reset of the **BLUEBIRD** is automatically initiated after 90 seconds if the call fails and the modem stays connected because the end of the call has not been detected. This feature ensures that there will be no modem "freezing".

3.6.7 Power Consumption

The **BLUEBIRD** includes a control and supervision system of the power source, giving an advantage to the **BLUEBIRD** compared to other existing solutions. The ATTS24 command enables the **BLUEBIRD** to initiate a sleep mode, reducing the power consumption (See Section 8: Technical Specifications for power consumption data). The **BLUEBIRD** "wakes up" if an incoming call or any activity from the DTE occurs.

3.6.8 Audio Performance

Any standard modem has a phone line interface (DAA), which converts TX and RX audio signals on 2 wires. Also, the Motorola interface makes reverse conversion of these signals. This process reduces the isolation between the RX and TX signals and at this time, an echo canceling function is required and difficult to perform. The **BLUEBIRD** provides an isolated TX and RX lines from end to end on the cellular network link, suppressing local echo canceling problems of standard modems, improving the quality of data transmission and also, reducing byte error rate and noise problems. Audio levels transmitted and received by the **BLUEBIRD** are dynamically adjusted, reducing audio compression effects of AMPS networks. These levels can be set by AT commands.

3.6.9 AT17 Command

With the AT17 command, the **BLUEBIRD** sends back information about the receiving level and the transceiver status (NO SVC, LOW BATT, LOCK, IN USE, FAST BUSY). See appendix A.

4 Standard Package Content

The standard **BLUEBIRD** package contains the following components:

- ?? 1 BlueBird modem (by BlueTree Wireless Data)
- ?? 1 RJ45 cable (for the Motorola 3 watts) or 1 SKN4291B cable (for the Motorola DPC)
- ?? 1 DC adaptor (for the Motorola DPC)
- ?? 1 user manual

Accessories for a fully customized product may be purchased from Blue Tree Wireless Data Inc.

5 Hardware and Software Requirements

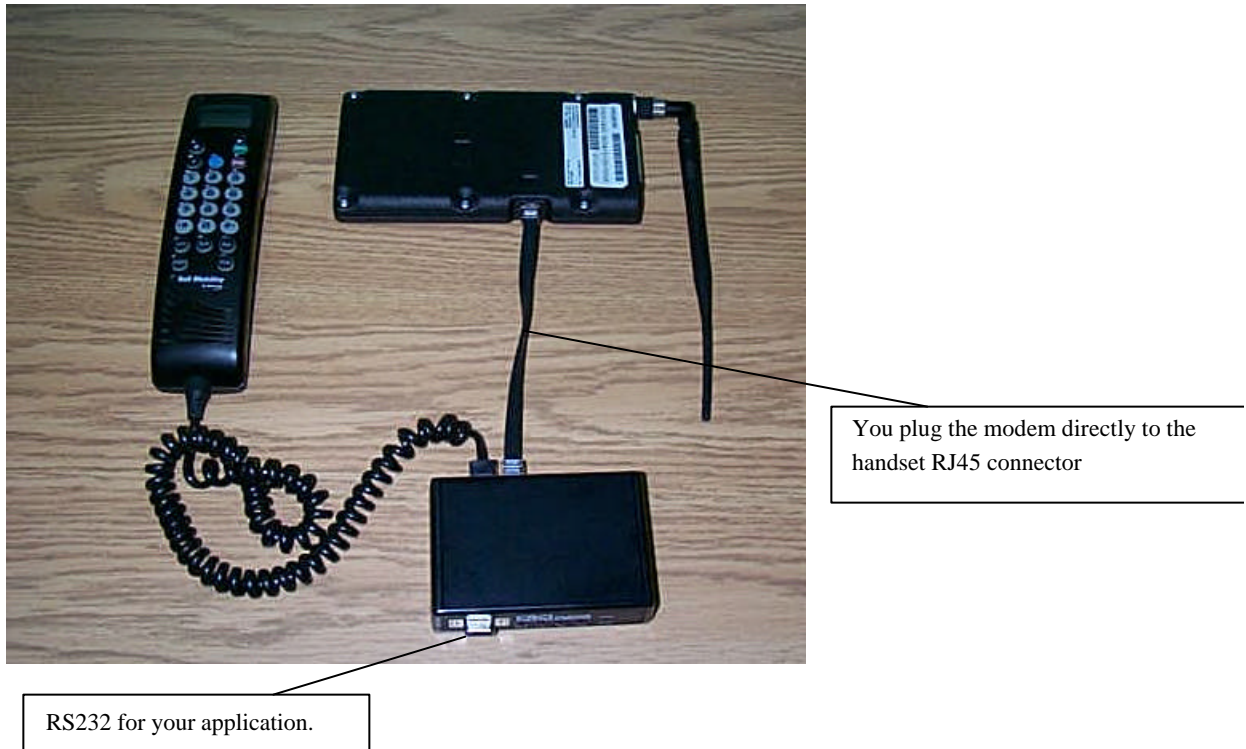
To have a fully operational mo dem, the installer must provide the following:

- ?? A Motorola transceiver: either a DPC 0.6-watt, or a 3-watt cellular telephone (depending upon which version of modem)
- ?? An activation of the above transceiver on the cellular network
- ?? An MNP10 compatible modem on the PC (host) to communicate with the BlueBird modem (We have tested and recommend the 56k BOCA Tidalwave external modem)

6 Installation Notes

Both versions of the **BLUEBIRD** (either 3-watt or 0.6-watt) are connected to the application device in the same manner – via the RS232 serial port. The 3-watt **BLUEBIRD** is powered by the cell phone, meaning **no power supply is required** to operate the modem. It draws the needed 100mA from the cell phone it is connected to. With the 0.6-watt **BLUEBIRD**, a 12VDC adaptor must be connected to the DC-in connector.

Figure 4 Motorola 3-watt transceiver connections



6.1 RS232 Connection

- ?? Connect the device that is to send./receive data via the modem to the DB-9 female connector on the modem.
- ?? Make sure that the pin designation matches properly (refer to Table 6), and that the application device is operating in DTE mode (terminal).
If the device is in DCE mode, a DCE-to-DCE connection is required: add a DCE-to-DCE adapter to the RS232 serial port of the BlueBird1.0, then connect the device to it.

Table 7 PIN designation

PIN #	DB-9 female on modem	DB-9 male after DCE-to-DCE connection
1	DCD	DCD
2	TXD	RXD
3	RXD	TXD
4	DTR	DSR
5	GND	GND
6	DSR	DTR
7	CTS	RTS
8	RTS	CTS
9	RI	RI

Note: the **BLUEBIRD** does not provide any power supply to the device.

6.2 Modem-to-Cellular Phone Connection

0.6-watt BLUEBIRD:

- ?? Insert the RJ45 cable into the TRU connector
- ?? Insert the SKN4192 cable into the Motorola DPC cellular phone

3-watt BLUEBIRD:

- ?? Insert the RJ45 cable into the TRU connector
- ?? Insert the other side of that RJ45 cable into the Motorola 3-watt transceiver
- ?? Connect the handset to the modem via the RJ45 H/S connector.

7 Customer Support

For customer/technical support please contact us at:

BlueTree Wireless Data Inc.

175 Montpelier Blvd.

St. Laurent, QC

Canada

Phone: **1-800-463-6945**

8 Technical Specifications

Dimensions (L x W x H)	BLUEBIRD (0.6-watt)	134mm x 13mm x 38mm (5.25" x 5.10" x 1.50")
	BLUEBIRD (3-watt)	114mm x 83mm x 32mm (4.50" x 3.25" x 1.25")
Weight	230g (8oz)	230g (8oz)
Environmental	Operating Temperature	-25 to 70 C (-13 to 144 F)
	Relative Humidity	0 to 95% non-condensing
Connectors	BLUEBIRD (0.6-watt)	1 Standard RS-232, 9-pin serial connector
		1 RJ45 connectors for Motorola DPC Transceiver
		1 MTA100, 4-pin connector, for 2 opto-isolated external resets (30 VAC/VDC @ 100mA max.)
	BLUEBIRD (3-watt)	1 Standard RS-232, 9-pin serial connector
		2 RJ45 connectors for Motorola 3 watts Transceiver and handset
		1 MTA100, 4-pin connector, for 2 opto-isolated external resets (30 VAC/VDC @ 100mA max.)
Regulatory compliance	FCC part 15, class B	
	D.O.C. certified	
Power Requirements	Working mode	Needs less than 100mA. (supplied by the cellular phone)
	Sleep mode	Needs less than 30mA. (supplied by the cellular phone)
LED Indicators	Transmit data	TX
	Receive data	RX
	Data terminal ready	DTR
	Carrier detect	CD
	Power and phone status	PWR/STAT
General	MNP10 for enhanced analog performance	
	14.4 Kbps	
	Shut off protection	
	Remote hard reset	
	2 external resets for peripherals	

Appendix A AT17 command results

Format: Sxxx

xxx = Status returned in decimal code from 000 to 027

Table 8 Cellular status returned by AT17 command from the BLUEBIRD

Sxxx	Corresponding status		
000	CONVERSION ERROR		
001	NO CONNECTION BETWEEN CELLULAR AND MODEM		
002	IN SERVICE		
003	NO SERVICE		
004	INCOMING CALL		
005	MODEM IN USE		
006	RELIEF PROCEDURE		
007	HANDSET IN USE		
008	IN SERVICE	LOCKED CELLULAR	
009	NO SERVICE	LOCKED CELLULAR	
010	INCOMING CALL	LOCKED CELLULAR	
011	IN SERVICE	FAST BUSY	
012	NO SERVICE	FAST BUSY	
013	IN SERVICE	REDIAL HANDSET	
014	NO SERVICE	REDIAL HANDSET	
015	I IN SERVICE	LOW BATTERY	
016	NO SERVICE	LOW BATTERY	
017	INCOMING CALL	LOW BATTERY	
018	MODEM IN USE	LOW BATTERY	
019	RELIEF PROCEDURE	LOW BATTERY	
020	HANDSET IN USE	LOW BATTERY	
021	IN SERVICE	LOCKED CELL.	LOW BATTERY
022	NO SERVICE	LOCKED CELL.	LOW BATTERY
023	INCOMING CALL	LOCKED CELL.	LOW BATTERY
024	IN SERVICE	FAST BUSY	LOW BATTERY
025	NO SERVICE	FAST BUSY	LOW BATTERY
026	IN SERVICE	REDIAL HANDSET	LOW BATTERY
027	NO SERVICE	REDIAL HANDSET	LOW BATTERY

Format: Rxxx

xxx = Reception level in decimal from 000 to 255

This table is for Motorola 3-watt EE3 transceiver.

Table 9 RSSI (Reception level) returned by ATI7 command of the 3-watt BLUEBIRD

Rxxx	Dbm	Rxxx	Dbm
000	Locked cell, RSSI reading error or incompatible transmitter = 000		
001	No connection between cellular and modem = 001		
050	-120	091	-79
051	-119	092	-78
052	-118	093	-77
053	-117	094	-76
054	-116	095	-75
055	-115	096	-74
056	-114	097	-73
057	-113	098	-72
058	-112	099	-71
059	-111	100	-70
060	-110	101	-69
061	-109	102	-68
062	-108	103	-67
063	-107	104	-66
064	-106	105	-65
065	-105	106	-64
066	-104	107	-63
067	-103	108	-62
068	-102	109	-61
069	-101	110	-60
070	-100	111	-59
071	-99	112	-58
072	-98	113	-57
073	-97	114	-56
074	-96	115	-55
075	-95	116	-54
076	-94	117	-53
077	-93	118	-52
078	-92	119	-51
079	-91	120	-50
080	-90	121	-49
081	-89	122	-48
082	-88	123	-47
083	-87	124	-46
084	-86	125	-45
085	-85	126	-44
086	-84	127	-43
087	-83	128	-42
088	-82	129	-41
089	-81	130	-40
090	-80		