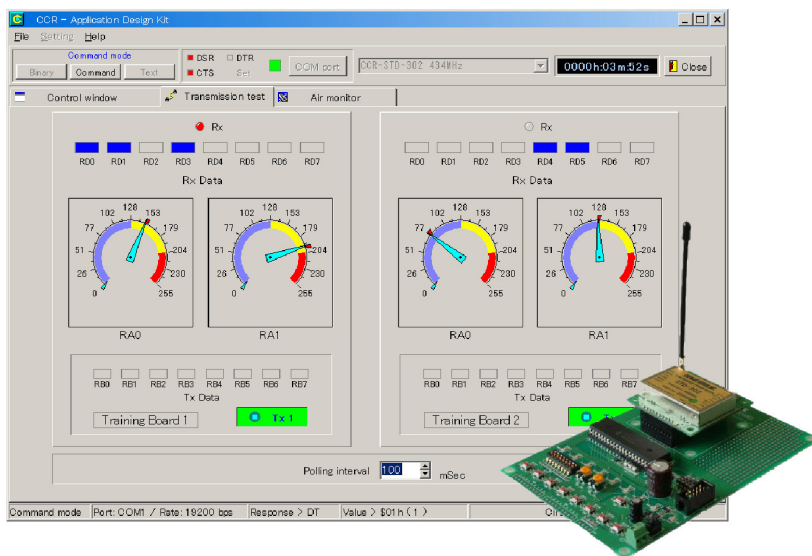# CCR Application Design Kit &

Sample Software

Command Controlled Radio Unit

Operation Guide

Version 1.1 (July 2003)

CIRCUIT DESIGN, INC.

CONTENTS

USAGE NOTE

1 The Training Board included in this kit was developed for the purpose of evaluation. Do not manufacture products using the Training Board.
The manufacturer is exempt from all responsibility relating to damage caused by mistake.

2 The "Sample software program for Windows" and the "Sample software program for the Training Board" supplied with the kit are exclusively developed for use with the CCR application design kit and should not be used with any other equipment. The manufacturer is exempt from all responsibility relating to damage caused by misuse of the program.

3 No part of this document or the program may be copied or distributed in part or in whole without the prior consent of Circuit Design, Inc. All rights are reserved by Circuit Design, Inc.

ABOUT THE APPLICATION DESIGN KIT

The application design kit is a programmable hardware kit for users who intend to develop applications using CCR units. The Training Board is equipped with a PIC microcontroller where the user can write a software program and basic peripheral components, making it possible for the user to perform various tests ahead of the development of their applications. This will ensure a smooth shift to the actual design and development.

The PIC microcontroller in the kit includes a simple sample program for communication between two Training Boards and between a PC and the Training Board. The source code of the sample program and the circuit diagrams of the Training Board attached to this document will help the user create their own program.
The sample program for PC works on various operating systems (Windows 95, 98, Me, 2000, XP).

Note: Read and understand the contents of the 'CCR operation guide' before use of the Training Board.

Features

1 A versatile Microchip PIC16F877-20/P is used as the control CPU.
2 Equipped with user-controllable tact switches, dip switches and variable resistors connected to the A/D conversion port.

    Output port: 8 ports (with output monitor LEDs)
    Input port :   8 ports (tact switches and dip switches)
    A/D conversion port: 3 ports

3 There is space for user components on the PCB.

CONTENTS OF THE APPLICATION DESIGN KIT

Check that all the following items are included in the kit before use.

Training Board x 2
UART-RS232 conversion board (CCR-UTR-01)x 1
UART-CONV board (with cable) x 1
RS232 straight cable (1.8 m) x 1
Battery holder for 9 V battery x 3
CD (Operation guide and software program) x 1

    Note: Battery is not included.

RS232 cable x 1   Operation guide/Software CD x 1   UART-CONV. board with cable x 1

Battery holder x 3

CCR Training Board x 2   UART-RS232 conversion board x 1
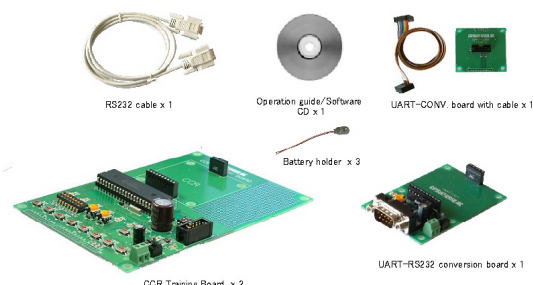
Contents of CD

Operation guide for the sample software program for the Training Board
Operation guide for the sample software program for Windows
Sample software program for Windows
CCR operation guide

PART NAMES AND FUNCTIONS

Training Board

(a) Connector for CCR

(p) Uiversal PCB part for user use

(b)·Pic μC socket

(o) Reset signal switch

(n) SW2 DIP SW for mode switch

(m) Connector for UART-CONVERSION board

(c) LED2..9 (RB0..7)

(l) SW3 (RA4)

(d) SW11 (RD0..7)

(k) Power SW (Main SW)

(e) VR1,VR2 (RA0,RA1)

(j) Connector for power source

(f) SW4..12 (RD0..7)

(g) CN9 (RD0..7)

(i) CN7 (RA2,3,5)

(h) CN6 (RB0..7)
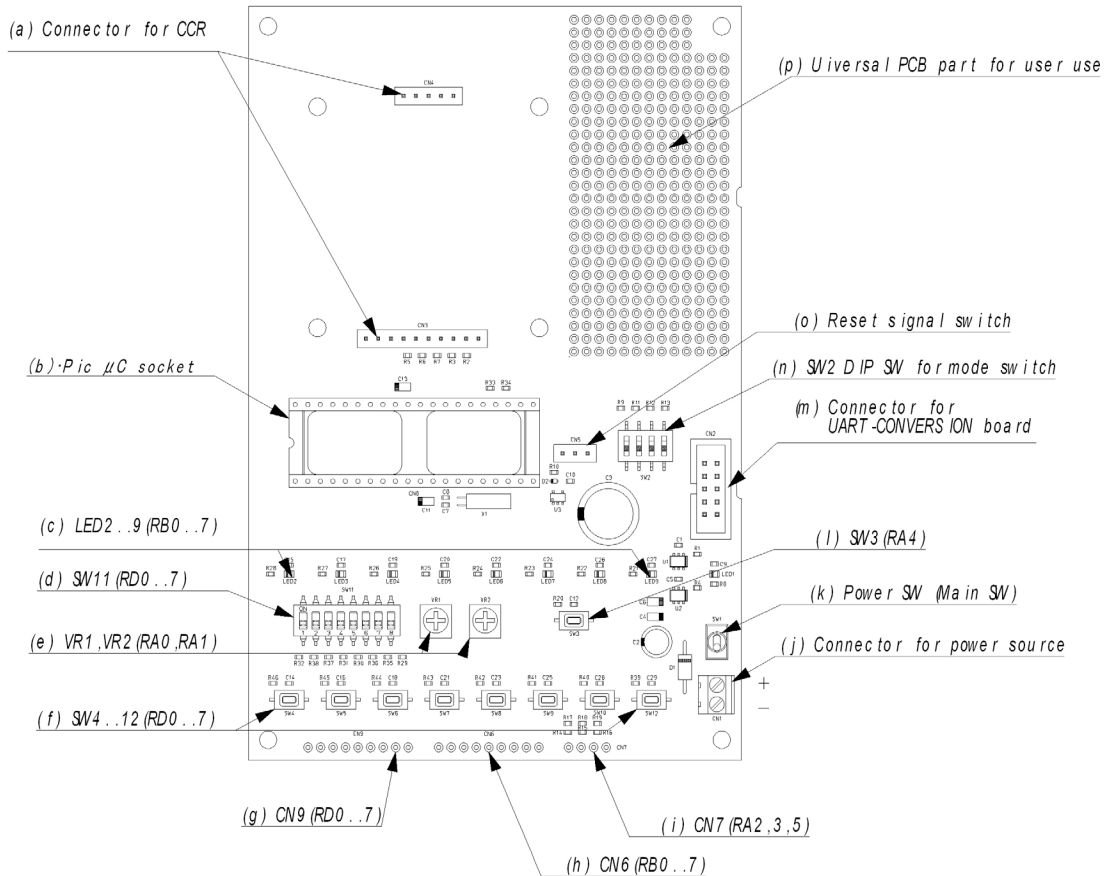
note1: RA, RB, RD = PIC micro computer terminal name.
note2: Refer to circuit diagram.
note3: SW2, SW3, SW4..12, VR1, VR2, SW11, LED2..9, CN6..9 can be reconfigured by user.

CCR Training Board

(a) Connector for CCR
Connector for mounting the CCR unit.

(b) Pic μC socket
Socket for PIC16F877A
Connect an ICE for the development of user software programs.

(c) LED2..9(RB0..7)
LEDs connected to the RB port of the PIC microcontroller
Use the RB port as an output port.

(d) SW11 (RD0..7)
Dip switches connected to the RD port of the PIC microcontroller.
Use the RD port as an input port.

(e) VR1, VR2 [RA0,RA1(AN0,AN1)]
Adjustable VR connected to the AN port of the PIC microcontroller.
Use the RA port as an A/D conversion port.

(f) SW4..12(RD0..7)
Tact switches connected to the RD port of the PIC microcontroller.
Use the RD port as an input port.

(g) CN9(RD0..7)
This is connected to the RD port of the PIC microcontroller.
Use the RD port as an input port.

(h) CN6(RB0..7)
This is connected to the RB port of the PIC microcontroller.
Use the RB port as an output port

(i) CN7(RA2,3,5(AN2,3,4))
This is connected to the AN port of the PIC microcontroller.
Use the RA port as an A/D conversion port.

(j) Connector for power source
Connect the battery holder included and use a 9 V battery.
If a power source other than 9 V battery is used, the supply voltage must be DC +4 V to 10 V. Check the polarity when the power source is connected.

(k) Power SW (Main SW)
Power switch for the Training Board.

(l) SW3(RA4)
This is connected to the RA4 port of the PIC microcontroller.
Use the RA4 port as an input port.

(m) Connector for UART-CONV board
The Training Board can be connected to the UART-CONV board using this connector.
This makes it possible to directly change the settings of the CCR unit mounted on the Training Board via the UART-RS232 conversion board.
The UART-CONV board must be mounted on the UART-RS232 Conversion board.

(n) SW2 (RE0..2, RC3)
Dip switches connect the RE0 to 2 ports and RC3 port of the PIC microcontroller.
Use these ports as input ports.
Each port becomes high level when the SW is turned off and becomes low level when the SW is turned on.

(o) Reset signal switch
Controls the reset signal line of the PIC microcontroller. Disconnect it when a debugger is used.
It is connected with the 1 and 2 pins and disconnected with 2 and 3 pins.

(p) Universal PCB part for user use
If necessary, user components can be mounted on this space.

UART-RS232 Conversion board (CCR-UTR-01)

(a) Connector for CCR
Connector for mounting the CCR unit.

(b) Power SW (Main SW)
Power supply ON/OFF switch

(c) Connector for power source
Connect the battery holder included and use a 9 V battery.

Note: If a power source other than a 9 V battery is used, the supply voltage must be DC +4 V to 10 V. Check the polarity when the power source is connected.

(d) D-Sub 9pin Connector
9 pin connector for RS232. Connect to RS232 using the straight cable included.
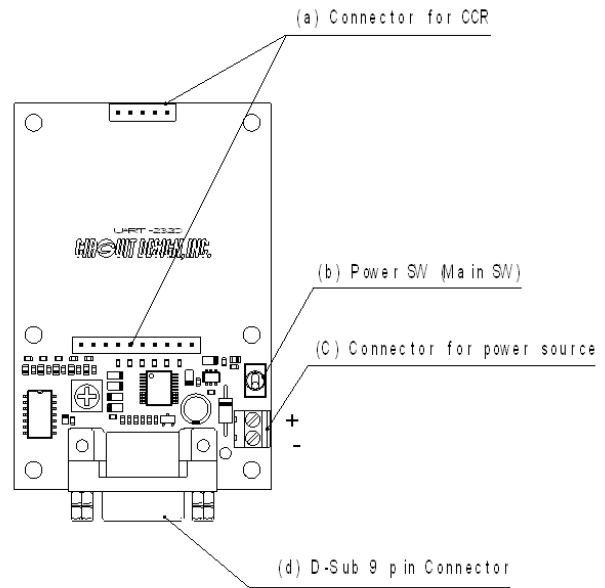
UART-RS232 Conversion Board (CCR-UTR-01)

Supply voltage

The supply voltage to the Training Board and the UART-RS232 conversion board must be within the range below. Check the polarity when the power source is connected.

	Training Board	UART-RS232 conversion board
Supply voltage	DC +4 V to + 10 V	DC +4 V to +10 V

CIRCUIT DIAGRAMS

CCR training board

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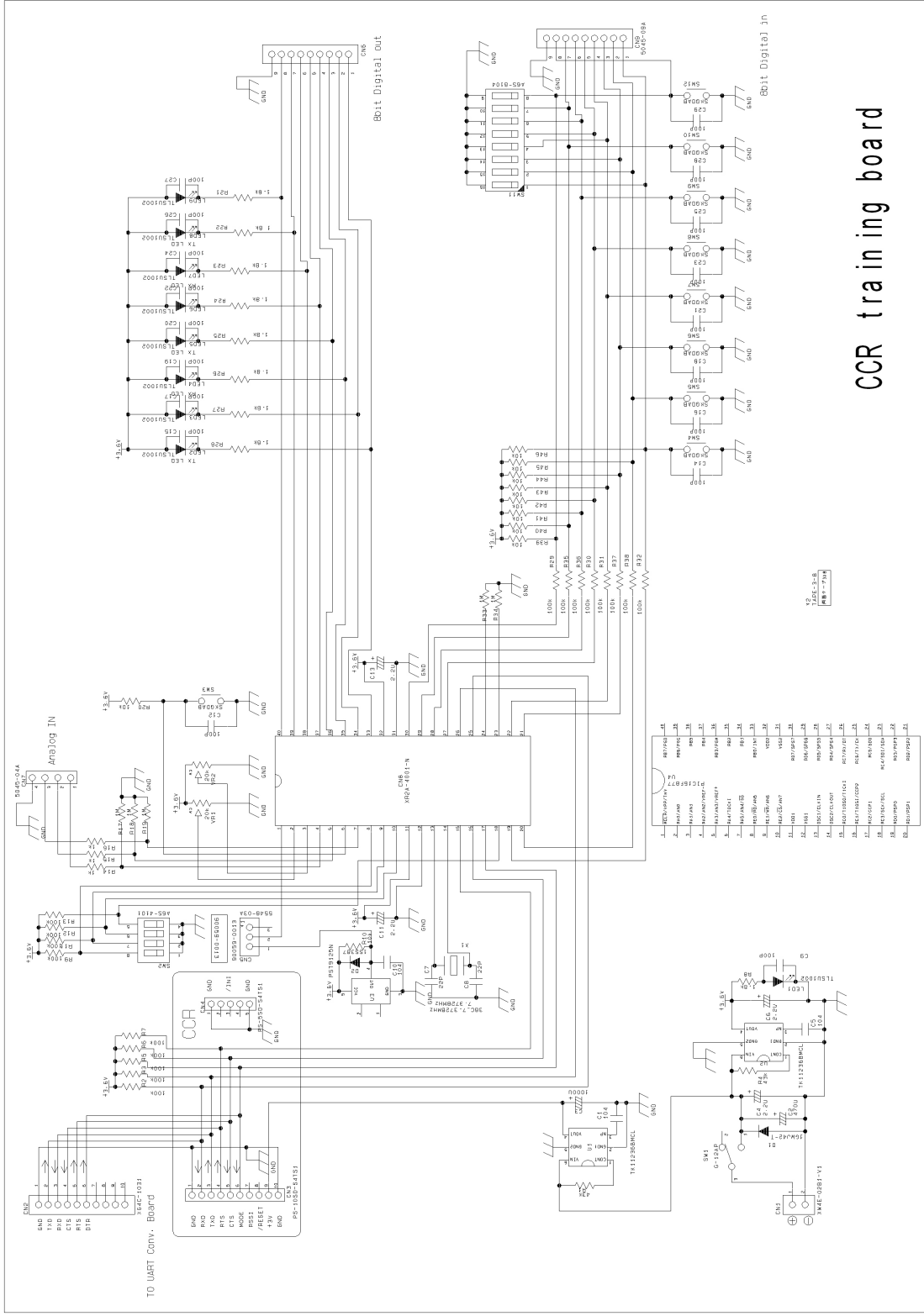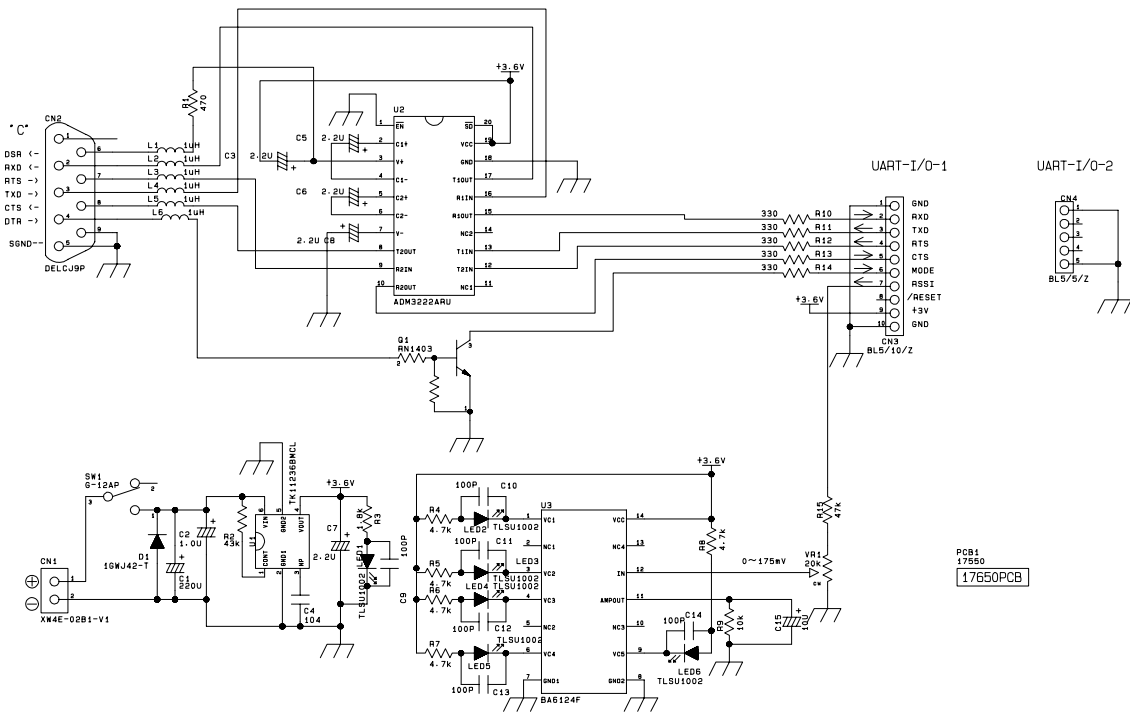
UART-RS232 Conversion Board (CCR-UTR-01)
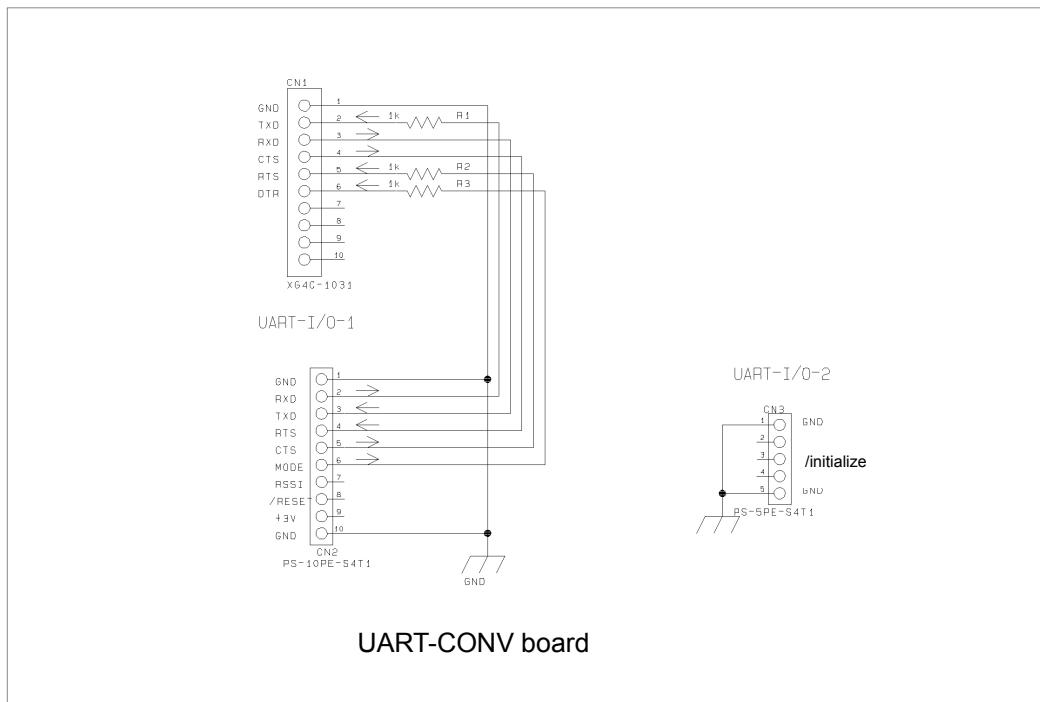
UART-CONV board

ABOUT THE SAMPLE SOFTWARE PROGRAM

This kit includes the sample software program for the Training Board and Windows which enables testing of the following three communication functions;

1. Data cyclic transmission between the Training Boards
2. Data ping-pong transmission between the Training Boards
3. Data ping-pong transmission between the Training Board(s) and PC

Read the "Sample software program for the Training Board" and the "Sample software program for Windows" in this document before running the software programs.

Preparation for starting up the program
1. Mount the CCR unit on the UART-RS232 conversion board and connect it to the COM port of the PC using the RS232 straight cable provided.
2. Mount the CCR unit on the Training Board and set the operation mode with SW2.
3. Turn on the UART-RS232 conversion board and the Training Board.

Program start-up
CCR units that are intended to communicate with each other must have the same system-ID, TX-ID, RX-ID and Frequency CH in order to start up the program. Reset the CCR units before starting communication using the following procedures;

1. Turn on the CCR unit while pressing the RESET switch.
2. Turn the power off and wait for about 3 seconds. Then turn the power on again.

The initial settings for the UART (or RS232) communication parameters of the CCR are as follows;

Baud rate = 19,200 bps, Data bit = 8 bits, Stop bits = 1, Parity = None

SAMPLE SOFTWARE PROGRAM for the Training Board

Program contents

The PIC microcontroller of the Training Board includes a program to perform the following communication functions;

1. Data cyclic transmission between the Training Boards
2. Data ping-pong transmission between the Training Boards
3. Data ping-pong transmission between the Training Board(s) and PC
4. Direct control of the CCR unit on the Training Board

Before performing each function, the each Training Board must be set to the master mode or slave mode. Each mode is enabled by setting the mode with SW2 (MODE DIP SW) and turning the power on.
The following modes 0 to 5 indicate the handling routines in the program.

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Functions

1. Data cyclic transmission between the Training Boards
The transmitter Training Board repeatedly transmits the tact switch data (SW4 to 12). The corresponding LED on the receiver Training Board comes on. If reception is lost for more than 100 ms, all LEDs go off.

Mode 1: Transmitter Training Board   Mode DIP SW: 1=ON   2=OFF   3=OFF   4=OFF
Mode 2: Receiver Training Board   Mode DIP SW: 1=OFF   2=ON   3=OFF   4=OFF

2. Data ping-pong transmission between the Training Boards
Using CCR units with a transceiver function, the Training Boards transmit and receive each other's tact switch data of each other. The received data is displayed by the LED. If reception is lost for more than 200 ms, all LEDs go off.

Mode 3: Master Training Board   Mode DIP SW: 1=ON   2=ON   3=OFF   4=OFF
Mode 4: Slave Training Board   Mode DIP SW: 1=OFF   2=OFF   3=ON   4=OFF

3. Data ping-pong transmission between PC and the Training Board(s)
Using CCR units with a transceiver function, data transmission can be performed between the master CCR unit controlled by the sample software program for Windows (included in the CD-ROM) on the PC and the slave Training Board. The tact switch data of the Training Board is displayed by the LED on the sample software program for Windows and the data transmitted by the sample software program for Windows is displayed by the LED on the slave Training Board.
Communication uses a polling method where the slave Training Board returns data in response to a query sent from the PC. If reception is lost for more than 2500 ms, all LEDs go off.

Two Training Boards can be used for this communication.

Mode 5: Slave Training Board 1   Mode DIP SW: 1=ON   2=OFF   3=ON   4=OFF
Mode 5: Slave Training Board 2   Mode DIP SW: 1=ON   2=OFF   3=ON   4=ON

The MODE DIP SW 4 is used to set the board number: OFF=Training Board 1 and ON=Training Board 2

4. Direct control of the CCR unit on the Training Board
The CCR can be directly controlled by the sample software program for Windows or an RS232 communication program such as HyperTerminal without removing the CCR unit from the Training Board.
Before using this function, mount the UART-CONV board on the UART-RS232 conversion board and connect it to the Training Board using the dedicated cable supplied with this kit.
Connect the UART-RS232 conversion board to the PC with the RS232 straight cable provided.

Mode 0: Mode DIP SW: 1=OFF   2=OFF   3=OFF   4=OFF

Sample software program for Windows

Program contents

With this software program, it is possible to establish communication with the sample software program for the Training Board and to issue various commands for understanding the operation of the CCR. Furthermore an air monitor function is available to check the situation of radio use in the field. A polling method is used for communication in the transmission test program.

Read and understand the contents of the CCR operation guide before using this program.

Control Window
The control window is used to check the operation of the CCR unit by sending commands and receiving the response from the CCR. The three modes (Command, Text and Binary) provided with the CCR can be tested and the principal CCR operation parameters can be written and fixed in EEPROM from this window.

Transmission test window
This window provides a function for establishing communication with a maximum of two Training Boards. The PC sends a query (request for the LED to come on) to the Training Board(s) and the Training Board(s) return their own data.

Air monitor window
This window provides a function to monitor the condition of radio use in the filed by using the RSSI level information from the CCR, and showing it in a graph. The graph can be set in either the Frequency domain or the Time domain.

1. Monitoring in Frequency domain
The RSSI level in each channel can be measured to provide information about the condition of radio use in the field. (The number of channels to be measured depends on the model of CCR).
The peak level can be held in each channel.

2. Monitoring in Time domain
The RSSI level of a pre-set channel can be measured in real time, which helps the user to check the antenna position or consider the position of the CCR.

➢The measured data can be saved and read.
➢The measurement result can be printed.
➢The measurement result can be saved as a Widows Extended Meta File (EMF).
➢Scrolling and Zooming function help with analysis.
➢Customizations of graph color and 3D display are possible.
➢Absolute received field strength can be indicated. (Note: Not all CCR models).

Software program operating environment

Operating system: Windows 95, 98, Me, 2000 and XP
Recommended CPU speed: 400 MHz or more
Hard disk space: 5 MB
Recommended display size: 1280 x 1024 pixels or more

Program development language

Delphi Ver.7

How to use

1. Connect the UART-RS232 board with the CCR mounted on it to the COM port of a PC. Please use the RS232 straight cable provided.
2. Turn on the main switch of the UART-RS232 board while pushing the RESET switch of the CCR unit. Turn the power off and restore it. This procedure sets the UART parameters and system ID to the default setting.
3. Click the "CCR_SP.exe" included in the "CCR_ADKit" folder in the "Circuit Design" folder created on the desktop to start the software program.
   The dialog explaining how to start the program is displayed when the program stars.
   Description: "Please select CCR unit first, then open COM port". Press "OK" to start the main program.
4. Select the CCR model to be used from the CCR unit selection box located to the right of the COM port button.
5. Open the COM port by clicking the COM port button. The operation screen is then displayed.
6. Follow the instructions in this guide for further operation.

Note: The default settings of the CCR communication parameters are 19,200 bps, 8 bits, 1stop bit and no parity. If the parameters are changed by commands, the parameters at the "COM port" in the setting menu also must be changed to the same settings.

Control window

Functions

The CCR unit can be set to one of the three modes (Command, Text, Binary) in the Control window. The "Transmission test" window and "Air monitor" window are available only in the Command mode.

Just after the COM port opens and when the Control window is selected again after the Air-monitor window, the software automatically reads the RF channel & RX-ID and re-sets the parameters. The screen in the Control window shows these parameters.

Note: Changing the unit and turning the power off should be done after the COM port is closed. Otherwise a COM port error occurs, which triggers closing of the program and may affect the operation of the operating system.

Data input-line

The commands can be issued to the CCR using the Data input-line.

The command or data entered in the Data input-line is transmitted when the Enter key is pressed. If the Enter key is pressed while pressing the Shift key, the characters input in the Data input-line are not cleared.

Screen

The screen displays the command and the character strings sent from the Data input-line and the response from the CCR.

It is not possible to issue commands on the screen, or to edit, print or save the screen. The amount of data can be checked using the screen data counter. When the total data amount exceeds 30,000 bytes, the content of the screen is cleared.

Issuing commands

The data transmission command DT should be followed by the data size and the data to be transmitted. DT command auto assignment panel makes it easy to transmit data with the DT command.

Screen details
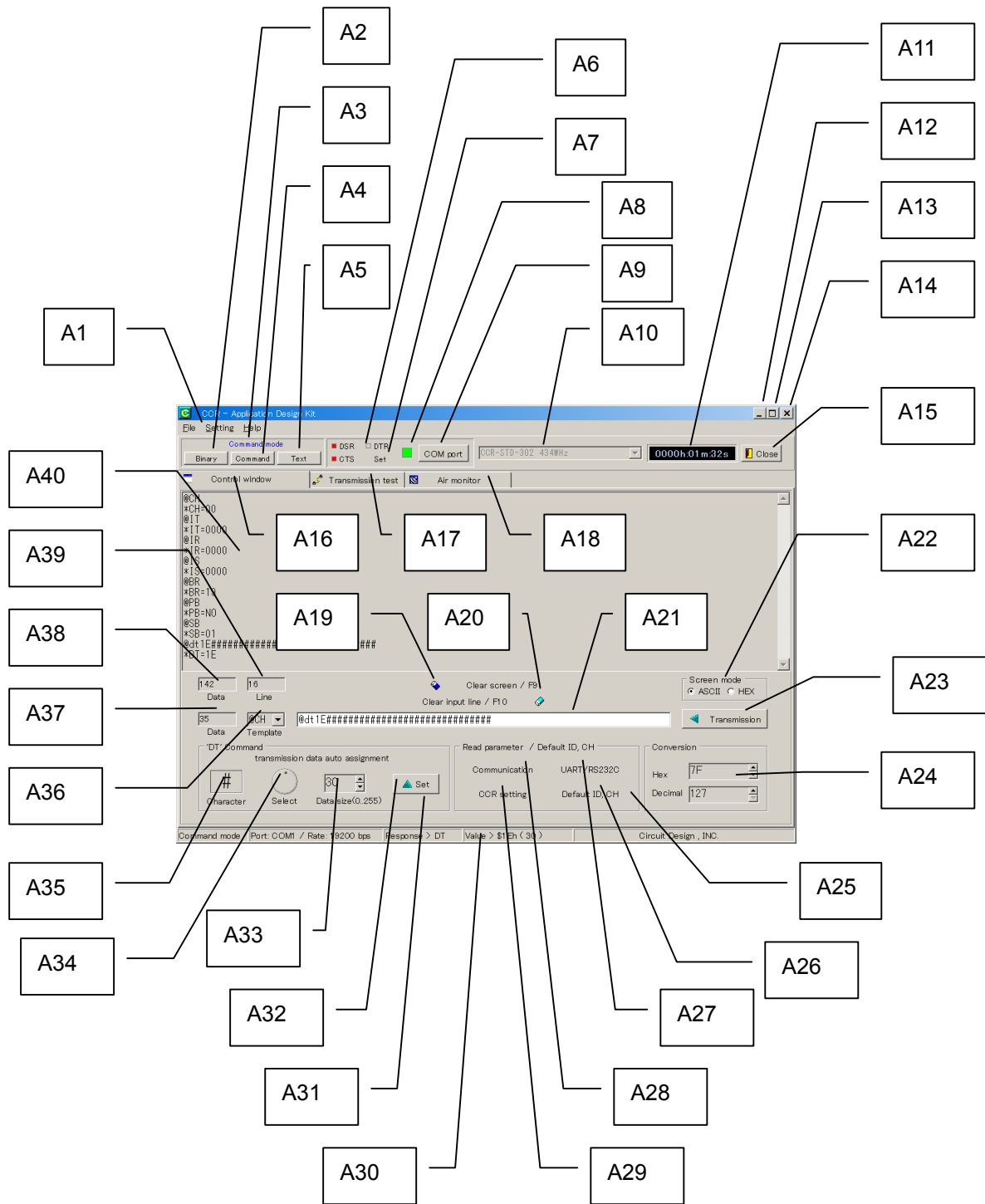
[A1] Menu bar

File menu	Close:	Closes the program
Setting menu	COM port:	Sets the COM port
Help menu	Version:	Shows the version

[A2] Binary mode button

Sets the CCR to Binary mode.

[A3] Mode indicator

Shows the currently set mode of the CCR.

[A4] Command mode button

Sets the CCR to the Command mode.

[A5] Text mode button

Sets the CCR to the Text mode.

[A6] COM port status indicator

Lights up when the port status is high
The DTR lights up when the CCR is set to the Binary or Text mode.

[A7] COM port setting button

Displays the setting dialogue of the COM port. The same setting as the communication parameter of the CCR should be set.

[A8] COM port indicator

Lights up when the port is open.

[A9] COM port button

Opens or closes the COM port.

[A10] CCR select box

Selects the CCR to be used.

[A11] Time counter

Timer. Reset using the left mouse button.

[A12] Minimize button

[A13] Maximize button (Please do not use)

[A14][A15] Program close button

[A16] CCR control window   (Shown here)

[A17] Transmission test window

[A18] Air monitor window

[A19] Screen clear button

[A20] Data input-line clear button

[A21] Data input-line
The command or data entered input in the Data input-line are transmitted when the Enter key is pressed. If the Enter key is pressed with pressing Shift key, the characteres input in the Data input-line will not be cleared.

[A22] Screen mode button
Switches between screen display modes. When ASCII is checked, ASCII characters are shown in the window. Control code is garbled on the window. When HEX is checked, the window shows 00 to FF hexadecimal digits.

[A23] Transmission button
Transmits the data in the Data input-line to the CCR.

[A24] Hexadecimal to Decimal conversion
Converts hexadecimal number to decimal and vice versa
First, double click the number in the window then enter a new number.

[A25] Parameter read panel
Reads all the CCR parameters related to each category as a group.

[A26] Default set for ID and Channel
Resets all of system-ID, TX-ID, RX-ID and channel to the default setting (0).

[A27] UART/RS232 parameter button
Reads the parameters related to serial communication.

[A28] CCR communication parameter read button
Reads the main parameters (CH, IR, IT and IS) for communication.

[A29] CCR unit setting read button
Reads the main parameters (MD, CT, EM, ST, VR) for unit setting.

[A30] Status bar
Shows operation status.

[A31] DT command auto assignment panel
For testing the "DT" command, characters can be assigned automatically. Click the SET button to enter the characters to the Data input-line, then click the Transmission button for the test.

[A32] DT command set button
Sets the selected character into the Data input-line with the assigned data size.

[A33] Data size select button
The @DT command can send 0 to 255-byte data at once.

[A34] Character select dial
Selects the characters for transmission. When the dial is selected with a lick (focused), the characters can be changed with the mouse wheel or the arrow keys of the keyboard.

[A35] Transmission character display
Shows the characters to be sent.

[A36] Command template
The command to be entered in the Data input-line can be selected.

[A37] Input line data counter
Shows the data size entered in the Data Input-line

[A38] Screen data counter
Shows the total data amount displayed on the screen. When the total amount of data on the screen exceeds 30,000 bytes, the content of the screen is cleared.

[A39] Screen line counter
Shows the number of the lines on the screen

[A40] Screen
Shows the commands issued to the CCR and responses from the CCR.
Note: Edit, Save, Print and Copy of data on the screen are not possible

Transmission test window

Functions

The Transmission test window provides functions for sending the data (1 byte) set by the "Transmitting LED data setting" button to the Training Board and then displaying the data of SW, VR1 and VR2 returned from the Training Board. A maximum of two Training Boards can be connected. If two Training Boards are used, the data of each Training Board is received alternately. Each of the B6 and B11 buttons is used to set one-byte data to turn on the LED on the Training Board. When the Training Board receives this data, it returns the SW data, VR1 and VR2 data of the Training Board.

Screen details
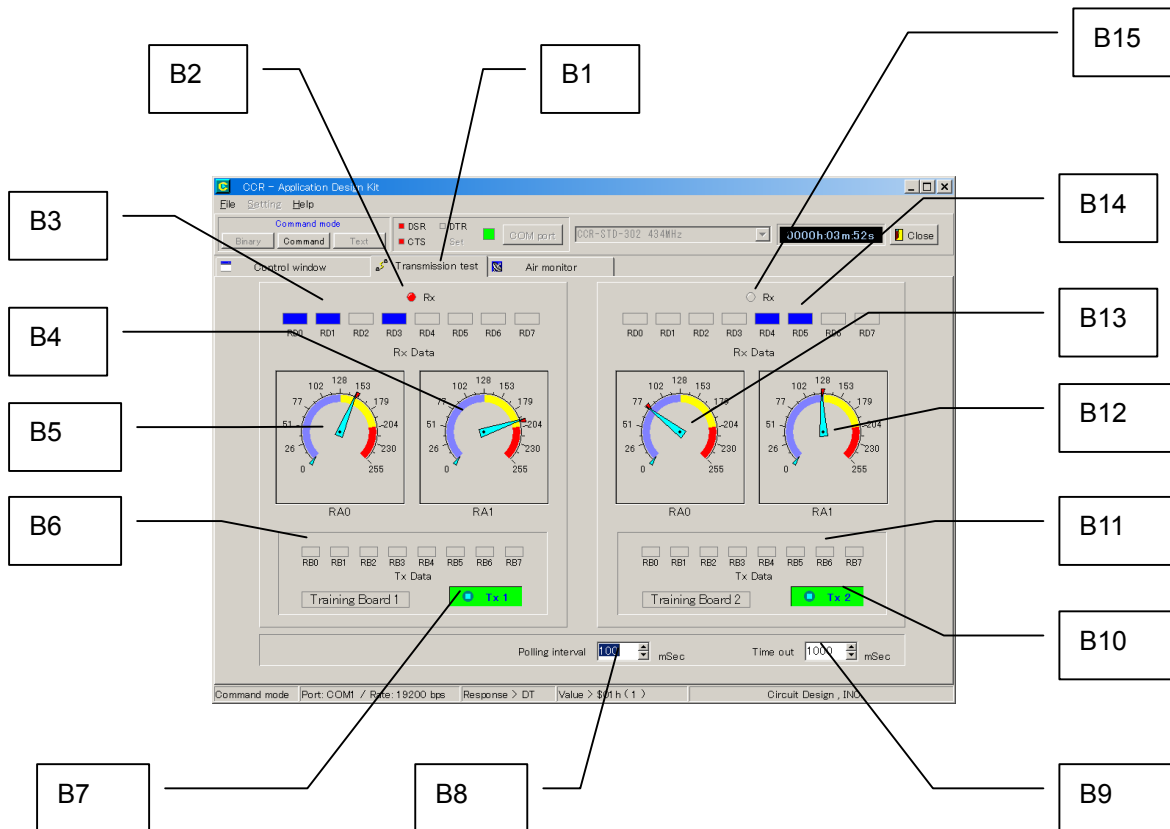
[B1] Transmission test window
The screen shown above.

[B2][B15] Data reception indicator
Comes on when data is received from Training Board 1 or Training Board 2.

[B3][B14] Reception switch data display
The tact switch data sent from Training Board 1 or Training Board 2 is displayed.

[B4][B12] Display for the A/D conversion data of the VR2 voltage
Displays the A/D conversion value of the VR2 terminal voltage of Training Board 1 or Training Board 2.

[B5][B13] Display for the A/D conversion data of the VR1 voltage
Displays the A/D conversion value of the VR1 terminal voltage of Training Board 1 or Training Board 2.

[B6][B11] Transmitting LED data setting button
Sets the data to turn on LED 2 to 9 on Training Board 1 or Training Board 2.

[B7][B10] Data transmission button
Transmits the LED data to Training Board 1 or Training Board 2.

[B8] Polling time setting button
Sets the polling time. This is the time required to perform a polling for one Training Board.

[B9] Time out setting button
Sets timeout. If reception is lost for more than the setting time, the reception data display is cleared.

Air monitor window

Functions
The Air-monitor window shows the level of RSSI in a graph using the RSSI reading function of the CCR. Any channel within a channel table of a connected CCR unit can be measured.
The result of measurement can be analyzed, printed, saved and loaded. RSSI level and channel frequency can be analyzed using the scroll and zoom functions in the graph.

The RSSI level is the output value from the internal 8 bit-A/D converter of the CPU on the CCR.
The scale at right shows the absolute received signal value (dBm). The accuracy is within a few percentage points, however this is not a guaranteed received value.

Note:
A CCR equipped with a transmitter module does not have a function to output RSSI level, therefore the Air-monitor window button does not appear.

Air monitor function check
The CT command makes it possible for the CCR to emit radio waves in the assigned frequency continuously. It can be used to check the Air monitor function.
Set the CCR to a desired frequency then send the command "@CT ON". The CCR starts emitting radio waves in the set frequency. To stop emitting, send the command "@CT OF".
The CCR stores the setting with the "/W" option command. The CCR emits radio waves whenever the power is on after the "@CT ON/W" command is issued.

Peak-hold
The peak of the RSSI level in each channel during measurement can be held. Continuous monitoring with this function gives information about which channel is used frequently in the field.

Use measurement results as data
The save and load file functions make it possible to re-use the measurement result. When the color setting of the graph is customized, the loaded graph data is shown in the customized color.

Use measurement results as image data
The measurement results as a graph can be saved as a Windows Extended Meta File (.EMF), which allows you to use the graph file in other application software i.e. Microsoft word, etc.
To convert the files into BMP or JPEG, please use image editing software. If the color of the graph has been customized, the graph is saved in the customized color.

Note:
Air-monitor measurement takes time to scan many RF channels. A setting of 38,400 bps or higher baud rate in the COM port gives a better response.

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Screen details (Frequency domain)
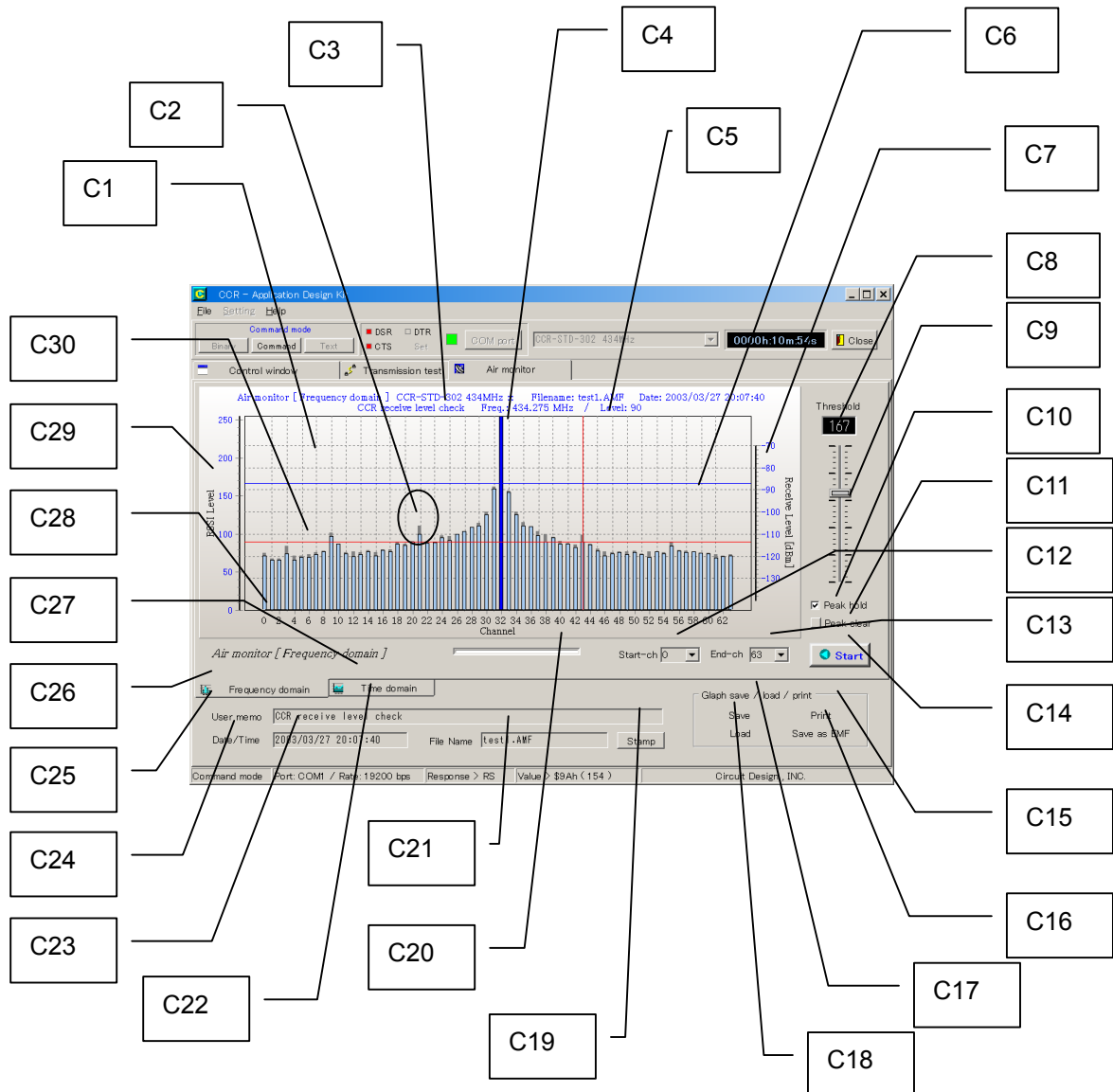
[C1] Measurement display in Frequency domain

[C2] Peak indication
Shows the peak value during measurement in each channel.

[C3] User memo
Memorandum for user use. The memo can be printed out and saved along with the graph. When the Stamp button is pressed, the memo is displayed in the graph area.

[C4] Analyzed frequency display
Shows the radio channel frequency whose RSSI level is analyzed.

[C5] Analyzed level display
Shows the RSSI level of the analyzed radio channel.

[C6] Threshold level line

[C7] RF received signal absolute level scale
Indicates the absolute level of radio received signal strength. Accuracy is within a few percentage points.
The value is only for reference.

[C8] Threshold level value

[C9] Threshold control
Sets a threshold for RSSI level. The level bars that exceed the threshold level, are displayed in a different color.
When a level bar is selected with a click (focused), the level can be changed with the mouse wheel or the arrow keys of the keyboard.

[C10] Peak-hold
Check this box to hold the peak value of the RSSI level in each channel.
Uncheck this box to enable the peak hold function.

[C11] Peak clear
Clears the Peak-hold values.

[C12],[C13] Scan start channel , Scan end channel
Sets a start channel and end channel for scanning. The scan (Air monitoring) is performed between these two channels.
Note: The number of the end channel must be higher than that of the start channel.

[C14] Start/Stop measurement button
Starts or stops the scan. Please do not change the window during measurement.

[C15] Print out button
Prints the measurement results.

[C16] EMF file save button
Saves the measurement result as a Windows Extended Meta File (.EMF).

[C17] File save button
Saves the graph data on the local disk. The file extension is ".AMF". Please do not change the extension.

[C18] File load button
Loads the saved graph data. Please do not load graph data with extensions other than ".AMF" .

[C19] Stamp button
Displays the contents of the User memo, Date/Time and File name line on the user memorandum area on the top of the graph.
Note: All contents in the graph can be printed out or saved as an EMF file.

[C20] Progress bar
Shows the progress of data measurement in each channel.

[C21] File name line
A file name to be used when the "Save" button is clicked. Please enter an appropriate name in "*" part.
Note: Please do not change the file extension ".AMF".

[C22] User memo input-line
Input-line for the memo to be displayed on the graph.

[C23] Date/Time line
A date and time to be stamped on the graph can be set.
Double-clicking the left mouse button here updates the Date/Time.

[C24] Date/Time button
Clicking this button updates the date and time in the Date/Time line to the current time.

[C25] User memo line clear button
Clears all characters in the line.

[C26] Frequency domain measurement select button

[C27] Time domain measurement select button

[C28] Measurement channel axis (horizontal axis)

[C29] RSSI level axis (vertical axis)
The output value from the internal 8 bit-A/D converter of the CPU on the CCR.

[C30] Analyze line

Screen details (Time domain)
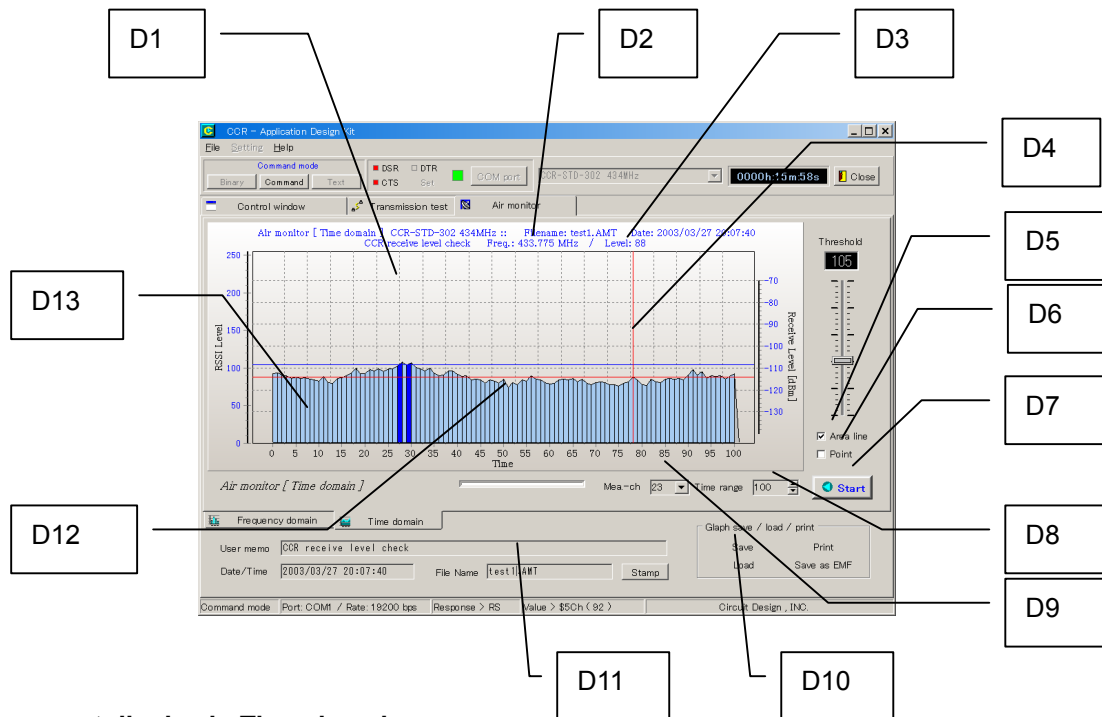
[D1] Measurement display in Time domain

[D2] Measurement frequency channel display
Shows the frequency of the radio channel being measured.

[D3] Level analyze result
Shows the RSSI level at the analyzed point.

[D4] Data analyze line

[D5] Area line display function select
Check this box to show an Area line on the graph.

[D6] Point display function select
Check this box to show a Point on the graph.

[D7] Start and stop button for measurement

[D8] Time range (10 - 5000 sampling)
Sets the number for sampling in 10-step increments. The number can be entered directly from the keyboard. When the number is entered directly from the keyboard, double click the current number and input a new number. When number is input, the color of the button changes. Press Enter to set the number.

[D9] Measurement channel
Selects the RF channel to be measured.

[De10] Save/Load button
Saves or loads the graph data.
Please do not change the file extension ".AMT".
Also, please do not load files with extensions other than .AMT.

[D11] File name line

The entered file name is used when "Save" button is clicked. Please enter an appropriate name in "*" part.

Note: Please do not change the file extension ".AMF".

[D12] Point

[D13] Area line

Mouse functions

1. Analyze function
Clicking the left mouse button on the graph shows the level and frequency of the channel. (The measurement should be stopped when this analysis is performed).

2. Graph scroll function
Clicking and holding the left mouse button scrolls the recorded graph to the left or right.

3. Graph zoom function
Clicking the left mouse button + SHIFT key enlarges the graph (Zooming).
Zoom in by selecting the graph area from the left top to the right bottom.
Zoom out by selecting the graph area from the right top to the left bottom. (Same with the pop-up menu)
Note: When scrolling and zooming in/out, mouse pointing should start outside of the measurement data.

4. Pop-up menu function
Call up the pop-up menu by clicking the right mouse button

Menu	
undo Zoom	E1
Graph view ▶	E2
Bar Style ▶	E3
Clear memo	E4
Gradient ▶	E5
Graph color ▶	E6
Save setting	E7
Default setting	E8
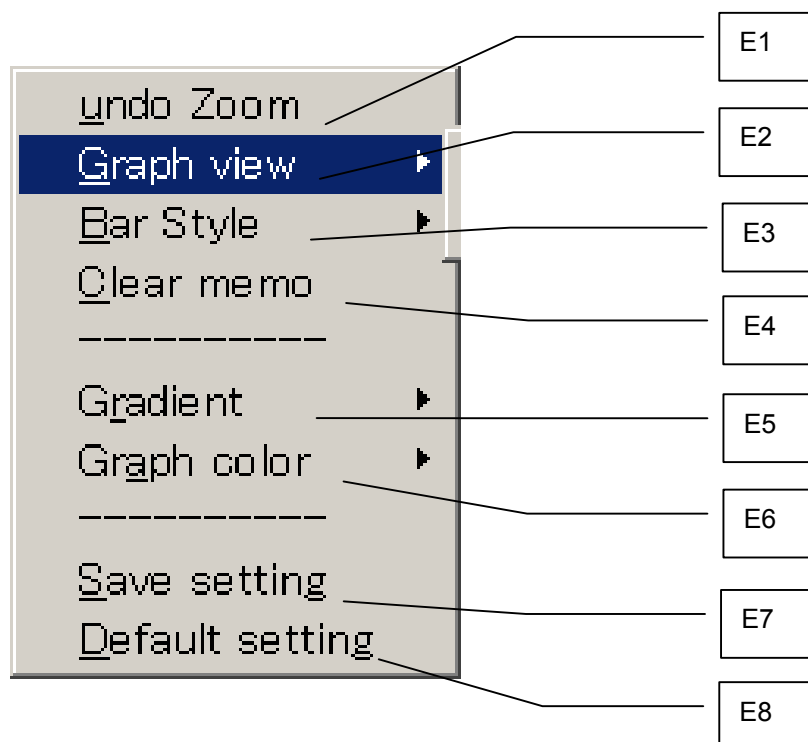
[E1] Undo Zoom
Resets the zoom setting to the original size

[E2] Graph view [3D, Normal]
3D: Shows the graph in 3D
Normal: Shows the normal graph

[E3] Bar style [LED, Point]
LED: Progress bar in LED style
Point: Progress bar in point style

[E4] Clear memo
Clears the memo displayed on the graph

[E5] Gradient [Start color, End color]
Start color: Sets the starting color for graph gradation
End color: Sets the ending color for graph gradation

[E6] Graph color [Freq. domain (Main, Over, Peak)] Time domain (Main, Over)]
Freq. Domain　　　– Main: Selects the color of the RSSI level bar
　　　　　　　　　　　– Over: Selects the color of bars that exceed the threshold level.
　　　　　　　　　　　– Peak: Selects the color of the peak-hold bar.
Time domain　　　– Main: Selects the color of the RSSI level bar.
　　　　　　　　　　　– Over: Selects the color of bars that exceed the threshold level.

[E7] Save setting
Saves the current color setting of the graph.

[E8] Default setting
Resets the color setting of the graph to default.

Instructions for use

The Air-monitor program operates the CCR with the RX-ID " ffff (Hex)". Please check the RX-ID (@IR) when testing in Control window or Data transmission window is performed after using Air-monitor.
The TX-ID and RX-ID must match to establish radio communication. Also the radio channel should be checked.

In Binary mode in the Control window, characters are transmitted each time they are entered in the Data input-line

To return to the Command mode from the Text mode, 1byte of ESC code (1B Hex) is sent to the CCR.

The DTR line in RS232 is used to switch the mode between Binary mode/Text mode and Command mode.

The RSSI level is an output value from the internal 8-bit A/D converter of the CPU on the CCR.

Do not change the Air-monitor window to other windows during the measurement, as this may change the RX-ID and/or Channel number. If this happens, please reset those parameters.

The CCR does not check the coverage of radio frequency channels. Do not set frequency channels that the radio module mounted on the CCR does not cover. Refer to the operation guide of the CCR for the radio frequency channel table.

Connecting the CCR and turning the power on/off must be performed after closing the COM using the COM port button. When an error occurs at the COM port, the evaluation software is closed and may affect the operating system of the PC.

USER SOFTWARE PROGRAM DEVELOPMENT

This section describes the items required to develop a user software program, taking the sample software program for theTraining Board and Windows as an example.

It is recommended to check the functions of the Training Board using the sample software program provided before creating a user program.

Hardware details

Parts and ports available to the user

The following ports and parts are available with the Training Board. Check the circuit diagram carefully before use.

    RB0 - 7 output port   8 ports (With output monitor LED 2 to 9)）
    RD0 - 7 input port   8 ports (Tact switch 4 -12 and dip switch SW 11)
    RA4   input port   1 port (Tact switch SW3)
    AN0 - 1 A/D conversion port   2 ports (Variable resistor VR1 and VR2)
    AN2 - 4 A/D conversion port   3 ports (CN7)
    RE0 - 2 Input port   3 ports (Dip switch SW2)
    RC3   input port   1 ports (Dip switch SW2)
    CN6, CN7, CN9
        The through holes for these connectors are available to the user. However, note that these signal lines are connected to various components. Special caution is required when using these connectors.

Default setting of the port function

Each port of the PIC microcontroller is connected to various components as shown in the circuit diagram. For the default setting of each port, refer to the following table.

Pin no.	Port name	Function	Pin no.	Port name	Function
1	MCLR	-	21	RD2	IN
2	RA0/AN0	AD	22	RD3	IN
3	RA1/AN1	AD	23	RC4	IN
4	RA2/AN2	AD	24	RC5	IN
5	RA3/AN3	AD	25	RC6/TX	TX
6	RA4	IN	26	RC7/RX	RX
7	RA5/AN4	AD	27	RD4	IN
8	RE0/AN5	IN	28	RD5	IN
9	RE1/AN6	IN	29	RD6	IN
10	RE2/AN7	IN	30	RD7	IN
11	VDD1	-	31	VSS2	-
12	VSS1	-	32	VDD2	-
13	OSC1	-	33	RB0	OUT
14	OSC2	-	34	RB1	OUT
15	RC0	IN	35	RB2	OUT
16	RC1	OUT	36	RB3	OUT
17	RC2	OUT	37	RB4	OUT
18	RC3	IN	38	RB5	OUT
19	RD0	IN	39	RB6	OUT
20	RD1	IN	40	RB7	OUT

Emulator

The Training Board is equipped with a Microchip PIC16F877-20/P. An ICE is required to create a software program using the Training Board. Refer to Microchip's web site for more details. When an ICE is used, the clock of the Training Board can be disconnected at CN5 if necessary.

Direct control of the CCR on the Training Board

The CCR unit on the Training Board can be directly controlled by the RS232 communication program (Sample software program for Windows or HyperTerminal) without being removed from the Training Board. Connect the UART-RS232 conversion board and the Training Board to the provided UART-CONV board using the dedicated cable. To use this function, the ports of the CCR must be disconnected from the PIC microcontroller and directly connected to CN2. To avoid signal collision, the user should create a program where the RC0, 1, 2, 6 and 7 ports of the PIC microcontroller can be set as input ports.

Note: The DTR line of HyperTerminal is fixed to high level and can not be controlled.

Sample software program for Training Board

Refer to the source code and the flowchart of the sample software program for program creation.

Source code

The source code of the sample software program is provided as the 'CCR_TB.asm' file (text file format) in the CD-ROM. The sample software program includes the minimum codes required to understand the CCR functions. For the actual software program, changing settings such as the channel and RX-ID requires an understanding of the command processing rules.
Refer to "How to develop a program for a system using the CCR" in the CCR operation guide for more details.

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Flow chart

Training board software program general flow chart 1

Main routine start

CPU initialize

SW2 status check

SW2-1 OFF
SW2-2 OFF
SW2-3 OFF

Port open mode
Mode 0

SW2-1 ON
SW2-2 OFF
SW2-3 OFF

Data cyclic transmission between the Training Boards
Mode 1

SW2-1 OFF
SW2-2 ON
SW2-3 OFF

Data cyclic transmission between the Training Boards
Mode 2

SW2-1 ON
SW2-2 ON
SW2-3 OFF

Data ping-pong transmission between the Training Boards
Mode 3

SW2-1 OFF
SW2-2 OFF
SW2-3 ON

Data ping-pong transmission between the Training Boards
Mode 4

SW2-1 ON
SW2-2 OFF
SW2-3 ON

Data ping-pong transmission between the PC and the Training Board(s)
Mode 5

OG_CCR-AD-KIT_v11e

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Training board software program general flow chart 2

Mode 0
- Port High impedance (input mode)

Mode 1
- SW data transmission @DT01 + data + CrLf
- Confirmation of command response

Mode 2
- Receive response detection
- Receive response?
  - Yes → Receiving data display
  - No

Mode 3
- SW data transmission @DT01 + data + CrLf
- Confirmation of command response
- Receive response detection
- Receive response?
  - Yes → Receiving data display
  - No

Mode 4
- Receive response detection
- Receive response?
  - Yes → Receiving data display
  - No → SW data transmission @DT01 + data + CrLf
- Confirmation of command response

Mode 5
- Receive response detection
- Receive response?
  - Yes → Receiving data display
  - No → Board ID check SW2~4
    - OFF → Training Board 1 SW,VR data transmission @DT05 + control data + data + CrLf
    - ON → Training Board 2 SW,VR data transmission @DT05 + control data + data + CrLf
- Confirmation of command response

Sample software program for Windows

This section explains what operations are performed by the sample software program for Windows when using the function of "Data ping-pong transmission between PC and Training Board" (Refer to the 'Sample software program for the Training Board' in this document).
The setting of the Training Boards is as follows;

    Slave Trainig Board 1 Mode DIP SW: 1=ON   2=OFF   3=ON   4=OFF
    Slave Trainig Board 2 Mode DIP SW: 1=ON   2=OFF   3=ON   4=ON
    Mode DIP SW4 is used to specify the board number. OFF=Training Board 1, ON = Training Board 2

Operation details

1. The sample software program sends 1-byte of data to turn on the LED on the Training Board specifying the RX-ID of the Training Board. In other words, the RX-ID of the Training Board selected as destination is specified in the TX-ID. If data is sent to Training Board 1, the TX-ID is specified as follows:

'@IT0001'C_RL_F
Then the following data is sent after confirmation of the transmitting LED data:
'@DT01'+LED data＋C_RL_F
This means the commands are continuously issued.

Note: For more information about continuous command processing and response processing, refer to "How to develop a program for a system using the CCR" in the CCR operation guide.

2. When the Training Board receives the 1-byte of data, it sends 5-byte of data including the control code, board number, SW data, VR1 data and VR 2 data to the CCR unit mounted on it.
  '@DT05'+ control code + Board number + SW data + VR1 data + VR2 data＋C_RL_F

3. The sample software program for Windows identifies the control code in the received response and then starts processing the other data.
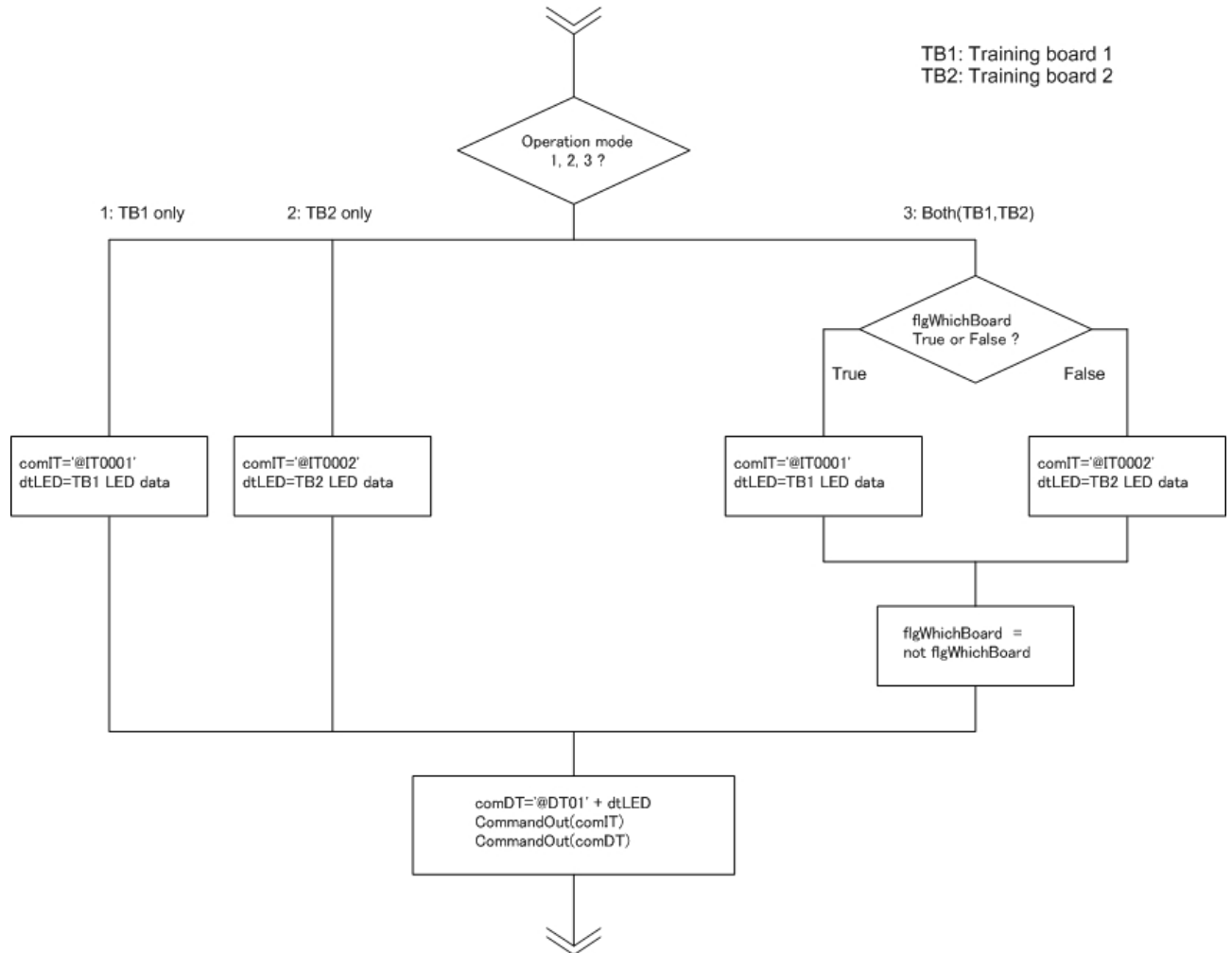 '*DT05'＋control code + Board number + SW data + VR1 data + VR2 data＋C_RL_F

For operation using two Training Boards, the operation is switched by specifying the destination Training Board and also by identifying the board number in the reception data.
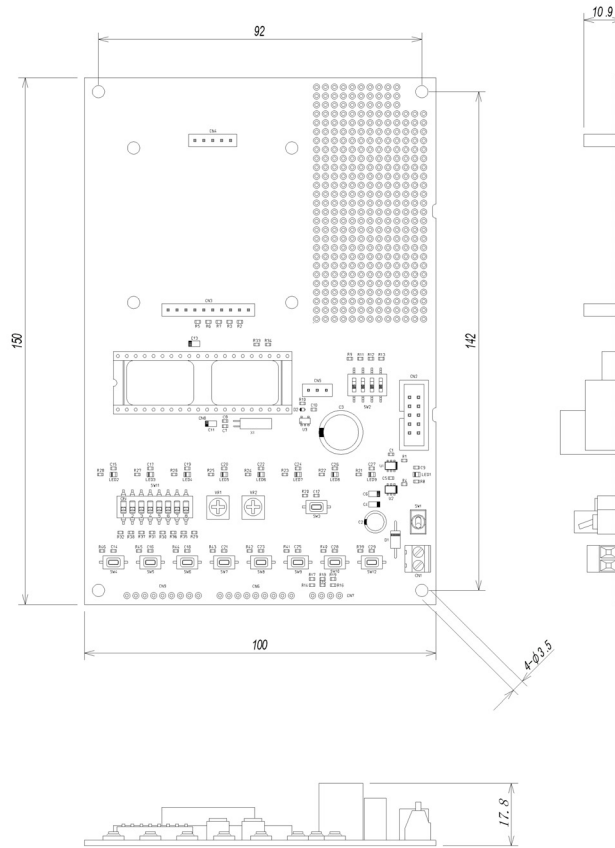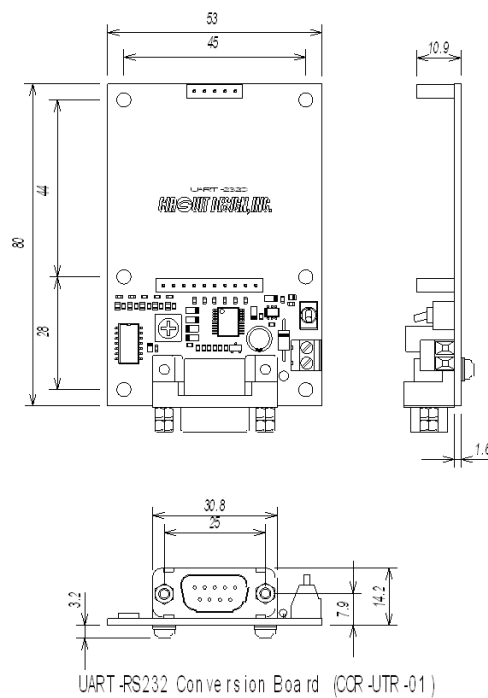
Flow chart

Sample program behavior

TB1: Training board 1
TB2: Training board 2

Operation mode
1, 2, 3 ?

1: TB1 only   2: TB2 only

3: Both(TB1,TB2)

flgWhichBoard
True or False ?

True   False

comIT='@IT0001'
dtLED=TB1 LED data

comIT='@IT0002'
dtLED=TB2 LED data

comIT='@IT0001'
dtLED=TB1 LED data

comIT='@IT0002'
dtLED=TB2 LED data

flgWhichBoard =
not flgWhichBoard

comDT='@DT01' + dtLED
CommandOut(comIT)
CommandOut(comDT)

EXTERNAL DIMENSIONS

CCR Training Board

UART-RS232 Conversion Board (CCR-UTR-01)

Cautions

- As the radio module communicates using electronic radio waves, there are cases where transmission will be temporarily cut off due to the surrounding environment and method of usage. The manufacturer is exempt from all responsibility relating to resulting harm to personnel or equipment and other secondary damage.
- Do not use the equipment within the vicinity of devices that may malfunction as a result of electronic radio waves from the radio module.
- The manufacturer is exempt from all responsibility relating to secondary damage resulting from the operation, performance and reliability of equipment connected to the radio module.
- Communication performance will be affected by the surrounding environment, so communication tests should be carried out before actual use.
- Ensure that the power supply for the radio module is within the specified rating. Short circuits and reverse connections may result in overheating and damage and must be avoided at all costs.
- Ensure that the power supply has been switched off before attempting any wiring work.
- The case is connected to the GND terminal of the internal circuit, so do not make contact between the '+' side of the power supply terminal and the case.
- When batteries are used as the power source, avoid short circuits, recharging, dismantling, and pressure. Failure to observe this caution may result in the outbreak of fire, overheating and damage to the equipment. Remove the batteries when the equipment is not to be used for a long period of time. Failure to observe this caution may result in battery leaks and damage to the equipment.
- Do not use this equipment in vehicles with the windows closed, in locations where it is subject to direct sunlight, or in locations with extremely high humidity.
- The radio module is neither waterproof nor splash proof. Ensure that it is not splashed with dirt or water. Do not use the equipment if water or other foreign matter has entered the case.
- Do not drop the radio module or otherwise subject it to strong shocks.
- Do not subject the equipment to condensation (including moving it from cold locations to locations with a significant increase in temperature.)
- Do not use the equipment in locations where it is likely to be affected by acid, alkalis, organic agents or corrosive gas.
- Do not bend or break the antenna. Metallic objects placed in the vicinity of the antenna will have a significant effect on communication performance. As far as possible, ensure that the equipment is placed well away from metallic objects.
- The ground for the radio module will also affect communication performance. If possible, ensure that the case ground and the circuit ground are connected to a large ground pattern.

Warnings

- Do not take a part or modify the equipment.
- Do not remove the product label (the label attached to the upper surface of the module.) Using a module from which the label has been removed is prohibited.