IRT Eurocard

Type MDC-3570

ASI/G.703 to G.703/ASI
Network Interface Adapter

Designed and manufactured in Australia

IRT can be found on the Internet at:
http://www.irtelectronics.com

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Network Interface Adapter

Instruction Book

Table of Contents

This instruction book applies to units later than S/N 0303001.

Operational Safety:

WARNING

Operation of electronic equipment involves the use of voltages and currents that may be dangerous to human life. Note that under certain conditions dangerous potentials may exist in some circuits when power controls are in the **OFF** position. Maintenance personnel should observe all safety regulations.

Do not make any adjustments inside equipment with power **ON** unless proper precautions are observed. All internal adjustments should only be made by suitably qualified personnel. All operational adjustments are available externally without the need for removing covers or use of extender cards.

IRT Eurocard
Type MDC-3570
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General Description
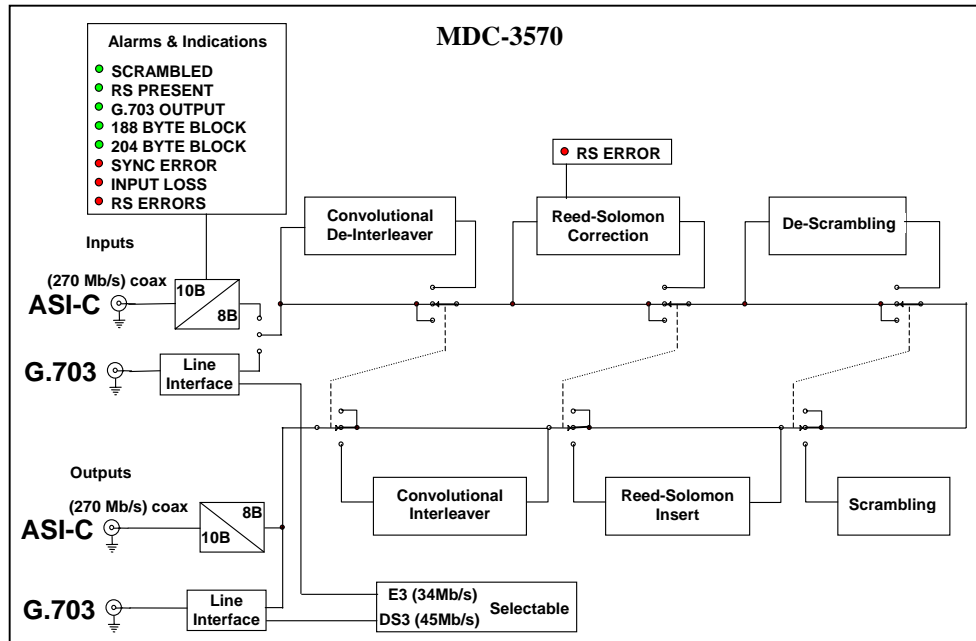
The MDC-3570 is part of a family of data transcoders for converting between the commonly used MPEG2 Transport Stream formats in the broadcast industry for video distribution.

The MDC-3570 can operate at ASI rates from2 Mb/s to 50 Mb/s. When set up for encoding, it can perform 188 to 204 byte conversion, scrambling, RS encoding and interleaving. When set up for decoding, it can perform de-interleaving, RS correction, descrambling and 204 to 188 byte conversion. All functionality is switch or link selectable.

The adapters find particular application interfacing for DVB-S applications such as in CATV/SMATV Headends where equipment from different manufacturers uses different interfaces or where connection to test equipment is required from various sources.

The MDC-3570 accepts ASI or G.703 input formats, and always provides an ASI output. G.703 input and output is selectable between DS3 (44.736 Mb/s) and E3 (34.368 Mb/s). G.703 output is provided if the input ASI or G.703 stream is at the correct DS3 or E3 rate (accounting also for rate conversion).

The MDC-3570 is fabricated in IRT's standard Eurocard format and may be housed in a variety of IRT's frames.

Standard features:

- **ASI to ASI/G.703 or G.703 to ASI/G.703 conversion.**

- **Reed Solomon insertion & correction.**

- **Interleaving or de-interleaving.**

- **Scrambling or de-scrambling.**

- **Packet length indication.**

- **Supplement to test equipment.**

- **188 to 204 & 204 to 188 byte conversion, where appropriate.**

Technical Specifications

IRT Eurocard module
Type/s MDC-3570

Input :

Type   1 x ASI, 75Ω BNC connector, or
                       1 x G.703, 75Ω BNC connector, link selectable.

ASI Rate   2 Mb/s to 50 Mb/s

G.703 Rate   E3 (34.368 Mb/s) or DS3 (44.736 Mb/s), selectable.

Outputs :

Type   1 x ASI-C 75Ω, 800 mVp-p, BNC connector.
                       (Burst or distributed (continuous) – link selectable)
                       1 x G.703, 75Ω BNC connector.
                          HDB3 at 34 Mb/s or B3ZS at 45 Mb/s, selectable dependent on output rate equalling desired G.703 rate.
                          (Output rate also dependent on input rate and if 188 to 204 or 204 to 188 processing enabled)

Alarms:

Major   Relay NO/NC link selectable,
                       (Relay energised when Input Sync is obtained).

Minor   Relay NO/NC link selectable,
                       (Relay energised when Input Sync is obtained and when there is a valid G.703 output rate).

Power Requirements: 28 Vac CT (14-0-14) or ± 16 Vdc.

Power consumption   <5.5 VA.

Connectors:

Other:

Temperature range   0 - 50° C ambient

Mechanical

Finish: Front escutcheon   Grey background, black lettering & red IRT logo
       Rear assembly   Detachable silk-screened PCB with direct mount connectors to Eurocard and external signals

Dimensions   6 HP x 3 U x 220 mm IRT Eurocard

Standard accessories   Rear connector assembly including matching connector for alarm output.

Optional accessories   TME-6 module extender card

                  Instruction manual.

Technical Description

The MDC-3570 processes either an ASI or G.703 input (link selectable) and outputs processed ASI-C at the input data rate. The G.703 output is valid if the output rate corresponds to the selected E3 or DS3 rate.

This module is capable of performing scrambling, de-scrambling, RS encoding, RS decoding, interleaving and de-interleaving. It can encode as well as decode different MPEG TS formats. The module is normally set up as either a decoder or an encoder. Certain combinations of functions are inhibited (e.g. de-interleaving of a 188 byte transport stream with or without 188/204 conversion enabled).

The processing functions are selected using three switches (interleaving, RS coding and scrambling) on the front panel. Each switch has three positions (up, centre or down).

> A switch set to the UP position applies processing to the decoding section.
> A switch set to the DOWN position applies processing to the encoding section.
> A switch set to the CENTRE position bypasses the decoding and encoding sections.

Applying a function to both the decoder and encoder section simultaneously is prevented mechanically by the switch.

ASI Output
ASI operates at 270 Mbit/s and uses 8B/10B coding with K28.5 stuffing bytes. The ASI cable output uses a 75 Ohm BNC connector. An ASI optical link can be used to transport the ASI-C signal via fibre optic cable. *See IRT Fibre link brochures or manuals for further information.*

G.703 Output
If the ASI rate at the input and the board links are as defined in Table 1.1 then the G703 output will be enabled. If the input data rate is outside the specified range then the G703 output will be muted.

OPERATION	Input Rate for valid G.703 Output (kb/s ± 20ppm)	
	E3 (LK1 IN)	DS3 (LK1 OUT)
No Rate Adaption (SW4A Off, SW4B OFF)	34,368	44,736
188 to 204 (SW4A ON, SW4B OFF)	31,672	41,227
204 to 188 (SW4A OFF, SW4B ON)	37,292	48,543

Table 1.1: Input Rate for Valid G.703 Output

Alarm relays
Major Alarm ("Loss of ASI sync") and Minor Alarm ("Loss of ASI sync" and "No Valid G703 Output") relay contacts are available on PL4 of the rear assembly. N/O or N/C contacts to ground are selected by link settings LK5 and LK6.

LED indicators
LED indicators 188 TS Byte length, 204 TS Byte length, RS error, Scram present, RS present are blanked during Input loss or sync loss.

Configuration

Link settings:

Warning:
Links may be changed without disconnecting power. However, when any link is changed, normal decoding of the MPEG TS will be disturbed. The time taken before normal decoding resumes is dependent on the decoder in use and may be up to five seconds.

LK1 - IN: selects E3 operation (34.368 Mb/s) for both input and output.
        OUT: selects DS3 operation (44.736 Mb/s) for both input and output.

LK2 - IN: selects G.703 input
        OUT: selects ASI input

LK3 - not used

LK4 - not installed

LK5 and LK6 - with link in position A then relay output is configured to be "normally closed",
        with link in position B then relay output is configured to be "normally open".

LK7 - not installed

Note: "normally open" indicates with the relay energised, the output looks like an open circuit to ground.
      With no power to the board, or with relay non-energized, the relay output is short circuit to ground.

Major Alarm - relay energised when Input Sync obtained.
Minor Alarm - relay energised when Input Sync obtained and valid G.703 alarm.

Switch settings:

SW4A ON   -   188 to 204 byte conversion enabled
SW4A OFF -   188 to 204 byte conversion disabled

SW4B ON   -   204 to 188 byte conversion enabled
SW4B OFF -   204 to 188 byte conversion disabled

SW4C ON   -   Payload data is evenly distributed in ASI output
SW4C OFF -   Payload data in each packet is contiguous in ASI output

SW4D ON   -   TEI[*] bit (Transport Error Indicator) set in outgoing stream if an uncorrectible error is detected.
SW4D OFF -   TEI[*] bit (Transport Error Indicator) in outgoing stream is unchanged.

SW4E ON   -   R-S led shows both correctible and uncorrectible errors
SW4E OFF -   R-S led shows uncorrectible errors only.
SW4F ON   -   not used
SW4F OFF -   not used

SW4G ON   -   TXLEV for G.703 DS3 is set for distances > 225ft
SW4G OFF -   TXLEV for G.703 DS3 is set for distances < 225ft.

SW4H ON   -   Receiver equaliser (G.703) disabled
SW4H OFF -   Receiver equaliser (G.703) enabled

Note that for a 188 byte input signal, SW4A must be ON for full encoding functionality (Reed Solomon, Interleaving).

CAUTION: Do not have both switches SW4A and SW4B ON at the same time.

* TEI – b7 of byte after sync byte.
If set, indicates current packet contains uncorrectable RS errors.
This bit is set by the MDC-3570 if SW4D is ON, the RS decoder is operating, the current packet has uncorrectible RS errors, and the output is not scrambled.

Installation

Pre-installation:

Handling:

This equipment may contain or be connected to static sensitive devices and proper static free handling precautions should be observed.

Where individual circuit cards are stored, they should be placed in antistatic bags. Proper antistatic procedures should be followed when inserting or removing cards from these bags.

Power:

AC mains supply: Ensure that operating voltage of unit and local supply voltage match and that correct rating fuse is installed for local supply.

DC supply: Ensure that the correct polarity is observed and that DC supply voltage is maintained within the operating range specified.

Earthing:

The earth path is dependent on the type of frame selected. In every case particular care should be taken to ensure that the frame is connected to earth for safety reasons. See frame manual for details.

Signal earth: For safety reasons a connection is made between signal earth and chassis earth. No attempt should be made to break this connection.

Installation in frame or chassis:

See details in separate manual for selected frame type.

Input/Output & alarm connections:

ASI & G.703 inputs and ASI & G.703 outputs are by 75Ω BNC connectors on the rear assembly.

Alarm outputs are by a 5-pin Phoenix style screw connector on the rear assembly. Alarms are by relay contacts. Links LK5 and LK6 set the Major Alarm (Relay 1) and the Minor Alarm (Relay 2) to be N/O or N/C to ground.
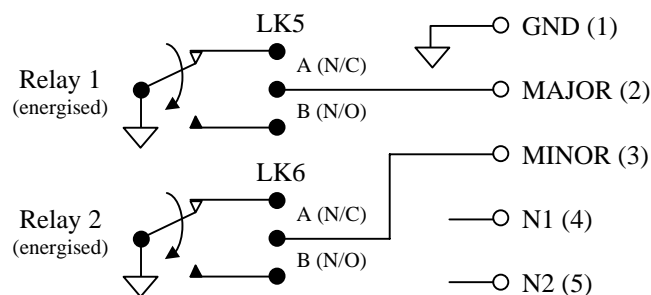
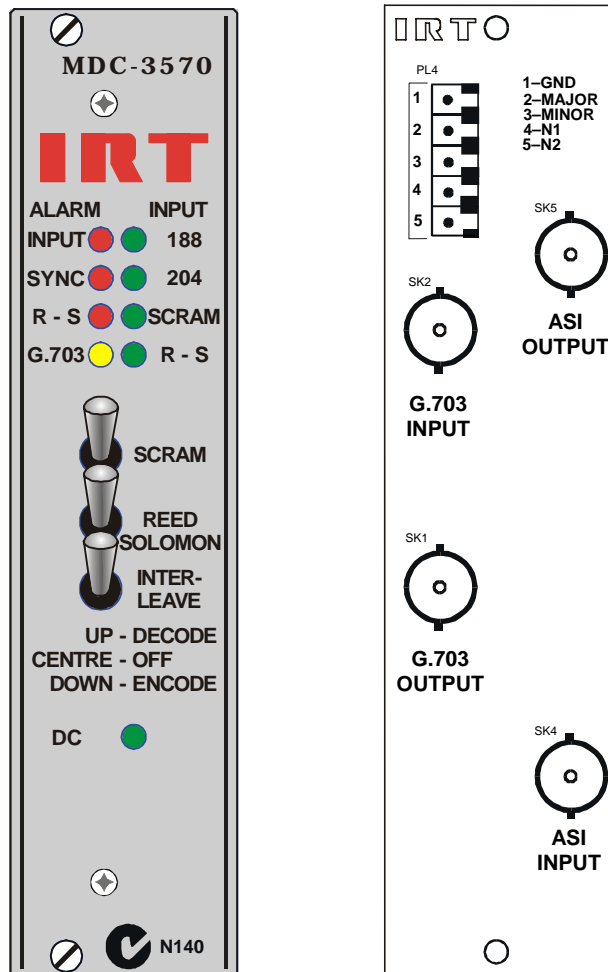The Major Alarm condition is "Loss of ASI sync".
The Minor Alarm condition is "Loss of ASI sync" and "No Valid G703 Output".
N1 – not connected.
N2 – not connected.

Front & rear panel connector diagrams

The following front panel and rear assembly drawings are not to scale and are intended to show connection order and approximate layout only.

Front panel (MDC-3570):

- MDC-3570
- IRT
- ALARM   INPUT
- INPUT (red) (green) 188
- SYNC (red) (green) 204
- R - S (red) (green) SCRAM
- G.703 (yellow) (green) R - S
- SCRAM
- REED SOLOMON
- INTER-LEAVE
- UP - DECODE
- CENTRE - OFF
- DOWN - ENCODE
- DC (green)
- N140

Rear assembly:

- IRT
- PL4
  - 1
  - 2
  - 3
  - 4
  - 5
- 1–GND
- 2–MAJOR
- 3–MINOR
- 4–N1
- 5–N2
- SK5 — ASI OUTPUT
- SK2 — G.703 INPUT
- SK1 — G.703 OUTPUT
- SK4 — ASI INPUT

Operation

The MDC-3570 primarily operates in either encode or decode mode. The three front panel switches determine the coding or decoding operations performed. All outputs contain the same coded information. Not all combinations of encoding and decoding are valid or optimal for use with MPEG2 transport streams. The user must be aware of the intended application and the Transport Stream format used.

Switches in the CENTER position do not affect encoding or decoding, switches in the UP position apply to decoding and switches in the DOWN position apply to encoding.

The application of certain processing functions is automatically blocked if the incoming stream is not in a suitable format, e.g. if the incoming Transport Stream contains 188 Byte packets then neither Interleaving, De-Interleaving, Reed Solomon encoding or Reed Solomon Decoding can be applied. The MDC-3570 provides a visual indication of the incoming Transport Stream format, e.g. Packet size 188/204, Scrambling or RS coding. These indicators help the user decide which processing functions are required.

In most encoding applications the switches would typically be in the center or down position. Whilst in most decoding applications the switches would typically be in the center or up position. It would be unusual to use switch combinations where one or more switches are in the up position whilst one or more switches are in the down position.

TS Transmission Formats

The application of scrambling, interleaving and RS encoding is required prior to satellite or terrestrial modulators (e.g. QPSK modulation for satellite). Interleaving and RS coding are almost always used together. Interleaving reduces the impact of burst errors by redistributing the error burst over multiple packets. Since the RS decoder can only correct up to 8 bytes per packet, this increases the likelihood of all the errors being corrected. If a packet has more than 8 errored bytes, an RS decoder will be unable to correct that packet. Scrambling or energy dispersal on the other hand helps maintain DC balance on the transmission line and allows equiprobable detection threshold to be used.

Front Panel Indicators:

Input loss alarm:
This LED lights when no ASI input is detected.

Sync loss alarm:
This LED lights when a valid MPEG-2 TS is absent and an ASI input is detected.

188 byte indicator:
This LED lights when a valid MPEG-2 TS with 188 byte packet length is input.

204 byte indicator:
This LED lights when a valid MPEG-2 TS with 204 byte packet length is input.

Scrambling presence indicator:
This LED lights when a valid MPEG-2 TS stream containing a byte sequence that corresponds to scrambling. A scrambling byte sequence uses an inverted 47H sync byte (B8H) every eighth sync to signify the start of the scrambling sequence.

R-S (Reed Solomon) presence indicator (Green):
This LED lights when Reed Solomon error correction bytes are present in place of the 16 dummy bytes of a 204 Byte MPEG-2 TS. The MDC-3470 considers any data content other than all 0's during the 16 dummy bytes to be RS correction bytes.

R-S (Reed Solomon) Error indicator (Red):
This LED lights for at least 300 ms when un-correctable R-S packets are detected. These correspond to packets with more than 8 bytes in error.

G.703 indicator (Yellow):
This LED lights when the output rate does not match the selected E3 or DS3 G.703 output rate.

Processing controls:

This module is capable of performing scrambling, de-scrambling, RS encoding, RS decoding, interleaving and de-interleaving.

In this context, the word scrambling refers to the process of randomisation for the purpose of energy dispersal of the signal. It does <u>not</u> refer to the encryption applied to Pay TV signals to control access to particular channels or programs.

For a description of the processes involved see *Application examples - Cable Systems* and *Technical specifications - Characteristics of signal types - MPEG-2 transport layer coding*.

The module is normally set up as either a decoder or an encoder. Combinations of both functions simultaneously should be avoided.

The processing functions are selected using three switches (interleaving, RS coding and scrambling) on the front panel. Each switch has three positions (up, centre or down).

A switch set to the UP position applies processing to the decoding section;
a switch set to the DOWN position applies processing to the encoding section; and
a switch set to the CENTRE position does not perform that function to either the decoding or encoding section.

In most instances, the MDC-3570 would be set to all encode or all decode.

SCRAM

REED SOLOMON

INTER LEAVE
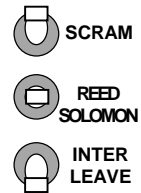
UP   - DECODE
CENTRE - OFF
DOWN   - ENCODE

Maintenance & storage

Maintenance:

No regular maintenance is required.

Care however should be taken to ensure that all connectors are kept clean and free from contamination of any kind. This is especially important in fibre optic equipment where cleanliness of optical connections is critical to performance.

Storage:

If the equipment is not to be used for an extended period, it is recommended the whole unit be placed in a sealed plastic bag to prevent dust contamination. In areas of high humidity a suitably sized bag of silica gel should be included to deter corrosion.

Where individual circuit cards are stored, they should be placed in antistatic bags. Proper antistatic procedures should be followed when inserting or removing cards from these bags.

Warranty & Service

Equipment is covered by a limited warranty period of three years from date of first delivery unless contrary conditions apply under a particular contract of supply. For situations when "**No Fault Found**" for repairs, a minimum charge of 1 hour's labour, at IRT's current labour charge rate, will apply, whether the equipment is within the warranty period or not.

Equipment warranty is limited to faults attributable to defects in original design or manufacture. Warranty on components shall be extended by IRT only to the extent obtainable from the component supplier.

Equipment return:

Before arranging service, ensure that the fault is in the unit to be serviced and not in associated equipment. If possible, confirm this by substitution.

Before returning equipment contact should be made with IRT or your local agent to determine whether the equipment can be serviced in the field or should be returned for repair.

The equipment should be properly packed for return observing antistatic procedures.

The following information should accompany the unit to be returned:

1. A fault report should be included indicating the nature of the fault
2. The operating conditions under which the fault initially occurred.
3. Any additional information, which may be of assistance in fault location and remedy.
4. A contact name and telephone and fax numbers.
5. Details of payment method for items not covered by warranty.
6. Full return address.
7. For situations when "**No Fault Found**" for repairs, a minimum charge of 1 hour's labour will apply, whether the equipment is within the warranty period or not. Contact IRT for current hourly rate.

Please note that all freight charges are the responsibility of the customer.

The equipment should be returned **to the agent who originally supplied the equipment** or, where this is not possible, to IRT direct as follows.

Equipment Service
IRT Electronics Pty Ltd
26 Hotham Parade
ARTARMON
N.S.W.   2064
AUSTRALIA

Phone: 61 2 9439 3744   Fax: 61 2 9439 7439
Email: service@irtelectronics.com

Characteristics of signal types

Coding characteristics

G.703:

The **HDB3** (High Density Bi-polar of order 3) code as defined in G.703 for 34,368 kbits/s is as follows:

Binary 1 bits are represented by alternate positive and negative pulses and binary 0 bits by spaces. Exceptions are made when strings of successive 0 bits occur in the binary signal.

Each block of 4 successive zeros is replaced by 000V or B00V where B is an inserted pulse of the correct polarity and V is an inserted pulse violating the polarity rule. The choice of 000V or B00V is made so that the number of B pulses between consecutive V pulses is odd so that successive V pulses are of alternate polarity and so no DC component is introduced.

The **B3ZS** (Bipolar with Three Zero Substitution) (Also designated **HDB2** - High Density Bi-polar of order 2) code as defined in G.703 for 44,736 kbits/s is as follows:

Binary 1 bits are represented by alternate positive and negative pulses and binary 0 bits by spaces. Exceptions are made when strings of successive 0 bits occur in the binary signal.

Each block of 3 successive zeros is replaced by 00V or B0V. The choice of 00V or B0V is made so that the number of B pulses between consecutive V pulses is odd, so that successive V pulses are of alternate polarity and so no DC component is introduced.

Drawing List Index

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804689	2	MDC-3570 circuit diagram – sheet 2
804689	3	MDC-3570 circuit diagram – sheet 3
804689	4	MDC-3570 circuit diagram – sheet 4

This is a schematic diagram (Sheet 1 of 4) for the MDC-3570 by IRT Electronics Pty. Ltd., ARTARMON NSW AUSTRALIA 2064.
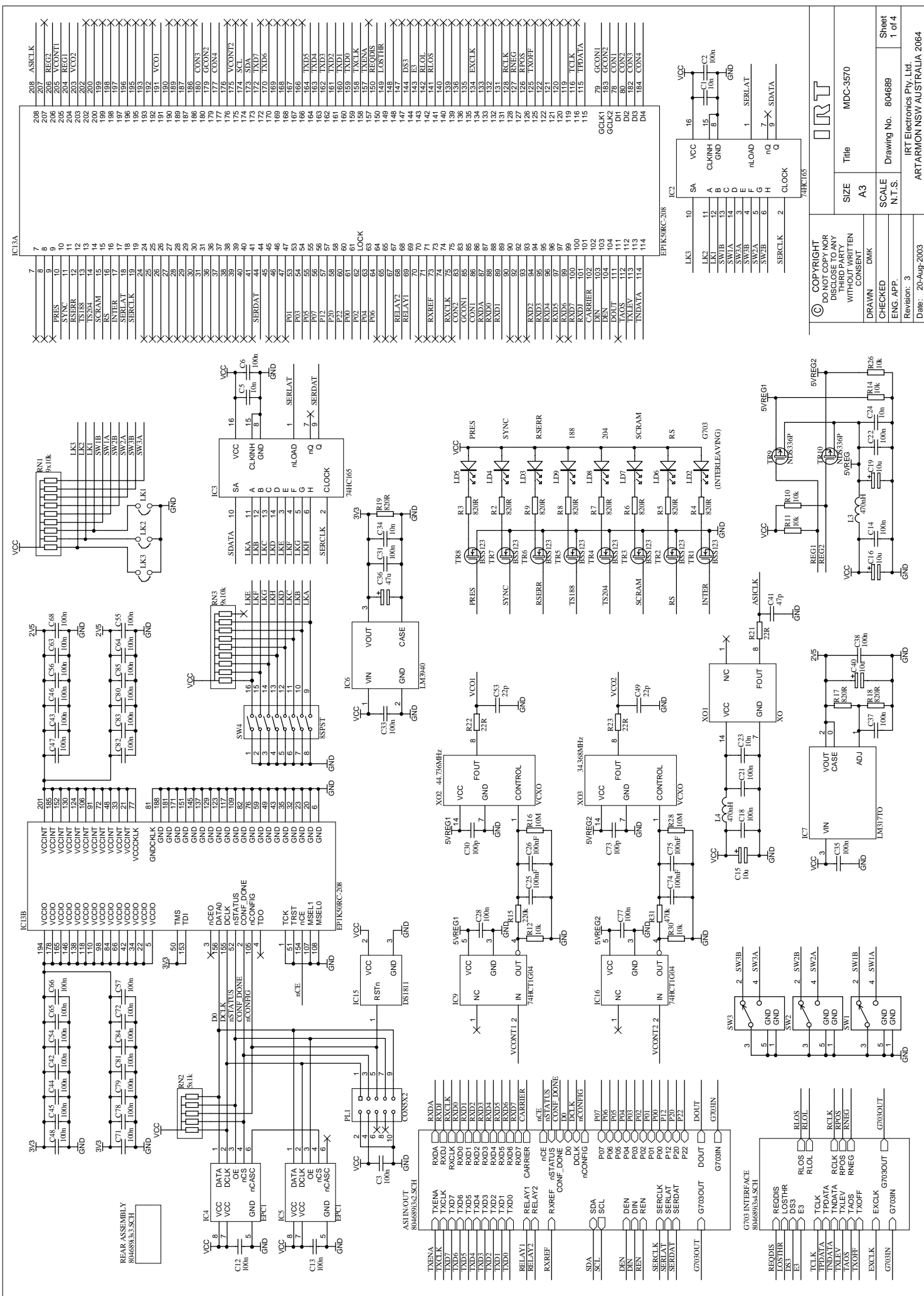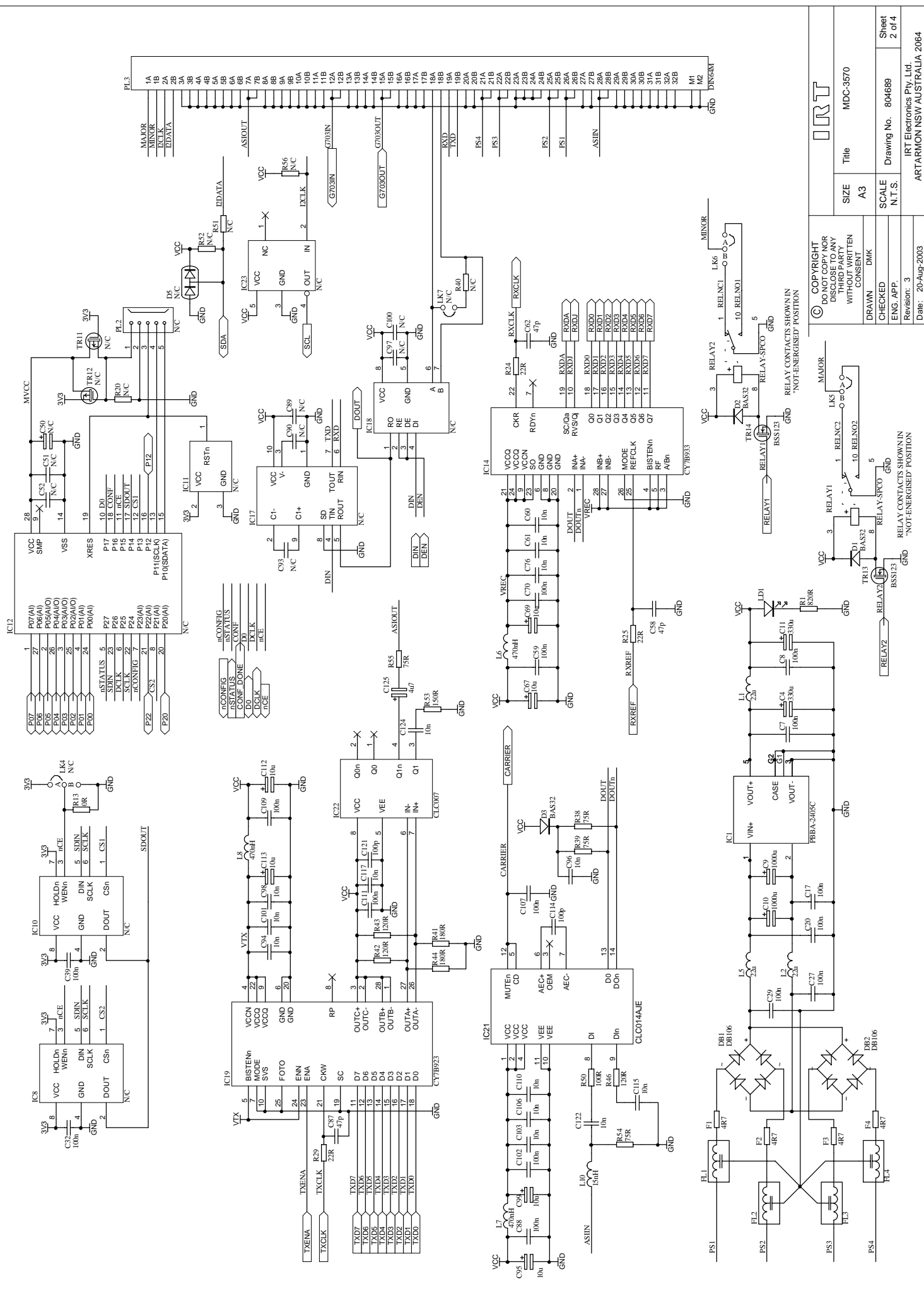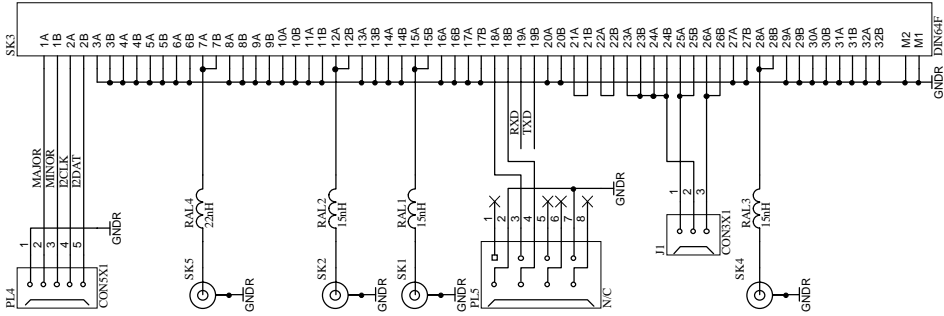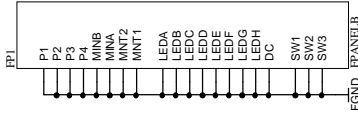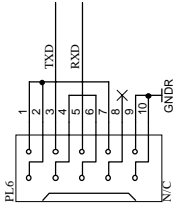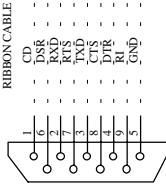
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- Title: MDC-3570
- SIZE: A3
- SCALE: N.T.S.
- Drawing No.: 804689
- Sheet: 1 of 4
- DRAWN: DMK
- CHECKED
- ENG. APP.
- Revision: 3
- Date: 20-Aug-2003
- COPYRIGHT DO NOT COPY NOR DISCLOSE TO ANY THIRD PARTY WITHOUT WRITTEN CONSENT

IRT Electronics Pty. Ltd.
ARTARMON NSW AUSTRALIA 2064

Title: MDC-3570

Drawing No. 804689

SIZE: A3

SCALE: N.T.S.

DRAWN: DMK
CHECKED:
ENG. APP.:
Revision: 3
Date: 20-Aug-2003

Sheet 2 of 4

IRT

	SIZE	Title	MDC-3570		Sheet
	A3				3 of 4

DRAWN	DMK
CHECKED	
ENG. APP.	

SCALE N.T.S.
Drawing No. 804689

Revision: 3

Date: 20-Aug-2003

SK3 DIN64F

1A 1B 2A 2B 3A 3B 4A 4B 5A 5B 6A 6B 7A 7B 8A 8B 9A 9B 10A 10B 11A 11B 12A 12B 13A 13B 14A 14B 15A 15B 16A 16B 17A 17B 18A 18B 19A 19B 20A 20B 21A 21B 22A 22B 23A 23B 24A 24B 25A 25B 26A 26B 27A 27B 28A 28B 29A 29B 30A 30B 31A 31B 32A 32B M2 M1 GNDR

MAJOR MINOR I2CLK I2DAT GNDR

PL4 CON5X1
1 2 3 4 5

SK5 RAL4 22nH GNDR
SK2 RAL2 15nH GNDR
SK1 RAL1 15nH GNDR
PL5 N/C GNDR
J1 CON3X1
SK4 RAL3 15nH GNDR

RXD TXD

RXD TXD

PL6 N/C
1 2 3 4 5 6 7 8 9 10 GNDR

FP1 FPANELB
P1 P2 P3 P4 MINB MINA MNT2 MNT1 LEDA LEDB LEDC LEDD LEDE LEDF LEDG LEDH DC SW1 SW2 SW3 FGND

RIBBON CABLE
CD DSR RXD RTS TXD CTS DTR RI GND
1 6 2 7 3 8 4 9 5

IRT

		SIZE	Title	MDC-3570	Sheet

IC20

XRT7300

TXLEV
TAOS
TXOFF
TNDATA
TPDATA
TCLK
EXCLK

RTIP
RRING

RCLK2INV
REQDIS
LOSTHR
LLB
RLB
STS1/nDS3
E3
HOST
LOSMUTEN
ENCODIS
DECODIS
nICT

TAVDD
TAVDD
RAVDD
DVDD
RDVDD

TAGND
TAGND
DGND
RDGND
RAGND
AGND

RCLK2
DMO
RLOS
RLOL
LCV

MTIP
TTIP
TRING

MRING

RCLK1

RNEG

RPOS

VCC
C108 10u
GND

TAVCC
L9 470nH
C116 100n
C120 100n
C119 100n
C104 100n
C105 100n
C91 100n
C92 100n

RLOS
RLOL

TTIP
TRING

RCLK
RNEG
RPOS

R36 22R
R35 22R
R34 22R

VCC
D4 BAV99
R47 33R
R45 33R
GND
T1 113B7
G703OUT
GND
D6 BAV99
GND

R27 22R
R33 22R
R37 22R
R32 22R

EXCLK
TCLK
TPDATA
TNDATA

TXLEV
TAOS
TXOFF

C86 22p
GND

VCC

REQDIS
LOSTHR

DS3
E3

GND

C118 10n
GND
R48 39R
R49 39R
GND

RTIP
RRING

D7 BAV99
VCC
T2 113B7
VCC
D8 BAV99
GND

G703IN
GND