

**Smarter
Timing
Solutions**

EndRun TECHNOLOGIES

3U FLV &H 7LPH DQG)UHTXHQF\ (QJLQH

8VHU·V ODOXD0

ENDRUN TECHNOLOGIES

Præcis Ce Time and Frequency Engine

User's Manual

© (QG5XQ 7HFKQRØRJHV
1 RUMKSRLQW 3DUNZD\
6DQND 5RVD &DQIRUQD 86\$
3KRQH ‡)D[

Preface

7KDON \RX IRU VHOFWLQJ WKH 3U



About this manual

7KLV PDQXD0 ZL00 JXLGH \RX WKURXJK LQWHJUDWLRQ DQG LQWHUIDFLOJ SURFHGXUHV

, QMURGXFWLRQ 2 7KH 3U FLV &H KRZ LW ZRUNV ZKHUH WR XVH LW LW PDLO IHDWXUHV
%DVLF , QWHJUDWLRQ 2 +RZ WR LQWHJUDWH \RXU 3U FLV &H ZLWK \RXU KRWW \V\WHP DQG WHVW RSHUDWLRQ
2SHUDWLRQ 2 ' HMDLOV RI WKH VRIWZDUH DQG KDUGZDUH LQWHUIDFH

, I \RX GHWHFW DQ\ LQDFXUDFLHV RU RPLWLROV SOHDVH LQIRUP XV (QG5XQ 7HFKQR0RJLHV FDQQRW EH KHOG UH
VSROVLEOH IRU DQ\ WHFKQLFDO RU WNSRJUDSKLFD0 HUURUV DQG UHVHUYHV WKH ULJKW WR PDNH FKDOJHV WR WKH SURGXFW
DQG PDQXD0V ZLWKRXW SULRU QRWLFH

Trademark acknowledgements

3DOLVDGH 6SHFWUDFRP 7ULPEOH 7UXH7LPH 76,3 DUH UHJLWVHUHG WJGHPDUNV RI WKH UHVHUYHV RI ENDRUN TECHNOLOGIES. 3(1) T3. 9

Warranty

7KLV SURGXFW PDOXIDFVXUHG E\ (QG5XQ 7HFKQR0RJLHV LV ZDUUDQWHG DJDLQVW GHIIHFW LQ PDMHULO DQG ZRUN PDQVKLS IRU D SHULRG RI RQH \HDU IURP GDWH RI VKLSPHQW XQGHU QRUPDO XVH DQG VHUYLFH ' XULQJ WKH ZDU UDQW\ SHULRG (QG5XQ 7HFKQR0RJLHV ZLOO UHSDLU RU UHSODFH SURGXFW ZKLFK SURYH WR EH GHIIHFMLYH

)RU ZDUUDQW VHUYLFH RU UHSDLU WKLV SURGXFW PXVW EH UHIXUQHG WR (QG5XQ 7HFKQR0RJLHV %X\HU VKD00 SUH SD\ VKLSSLQJ FKDUJHV WR (QG5XQ 7HFKQR0RJLHV DQG (QG5XQ 7HFKQR0RJLHV VKD00 SD\ VKLSSLQJ FKDUJHV WR UHIXUQ WKH SURGXFW WR %X\HU +RZHYHU %X\HU VKD00 SD\ D00 VKLSSLQJ FKDUJHV GXMLHV DQG WDLHV IRU SURG XFWU UHIXUQHG WR (QG5XQ 7HFKQR0RJLHV IURP DQRWKHU FRXQW\

3URGXFW QRW PDOXIDFVXUHG E\ (QG5XQ 7HFKQR0RJLHV EXW LQFOXGHG DV DQ LQWJUDO SDUW RI D VVWHP HJ SHULSKHUD03. UHFRUGLQJ (RPH). 12 0 Td)Tj493. 84 0 Td)Tj4. 2 0 Td)Tj4. 91997 0 Td)Tj SH H0FGX

12 0 Td)Tj493. 84 0 Td)Tj4. 2 0 Td)Tj4. 91997 0 Td)Tj



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Each base station contains at least one state-of-the-art GPS timing receiver with an ultra-stable local oscillator.

7KH \V\WHP GHV\JQHUV FKR\H WKH *ORED 3RV\LRQLQJ 6\WHP *36 ZKLFK LV LW\HOI D &' O\$ EDVHG \V\WHP DV WKH PHDQV RI PDLQNDLQLQJ \VQFKURQL]DNLRO DQG WKH\ GHILQHG \V\WHP WLPH WR EH *36 WLPH (DFK EDVH WDWLRO WKURXJKRXW WKH \V\WHP FROWDLOV ROH RU PRUH KLJK SHUIRUPDQFH *36 WLPLOJ UHFHLYHU ZLWK VRSKLV\ FDIHG DJRULWKPV WKDW FROWURO HLWKHU DQ H[WUHPH\ WDEOH RYHQ]HG TXDUW] FU\WDO RVFLOODWURU RU D 5XELGLXP YDSRU DMRPLF IUHTXHQF\ WDOGDUG 6XFK HDERUDWH PHDQV DUH QHHGHG WR PHHW WKH YHU\ GLILFXOW RSHUDWLOJ VSHFLILFDWLRQV UHTXLUHG E\ WKH 7,\$ (,\$,6 WDOGDUG 7KH EDVH WDWLRO WLPH \VQFKURQL]DNLRO PXW UHPDLO ZLWLO PLFURVHFROGV RI *36 WLPH RYHU SHULRGV DV ORQJ DV WZHOWN IRXU KRXUV GXULQJ ZKLFK *36 WDWLRO V\JQDQV PLJKW ORW EH DYDLODEOH \SLFD\ GXH WR DQ\HOOD FDEH IDL\XUH GDPDJH RU YDQGDQVP DQG LQ DQ HOYL URQPHQW ZKHUH ODJH DPELHQW WHPSHUDW\UH VZLQJV PD\ RFFXU (TXLSPHQW FDSDEOH RI PHHWLOJ WKHVH UHTXLUHPHQW LV DW WKH FXUHQW WDWLRO RI WKH DUW

The base stations transmit a sync signal that all of the phones must use to establish and maintain system time.

7KH 3U FLV &H UHFHLYHU WKH VDPH LQVLDQL]DNLRO V\JQDQV WDOQVPLW\HG E\ WKH EDVH WDWLROV WKDW DUH XVHG E\ WKH PRELOH W\HHSKROHV WR HWDEOLVK WKHU \VQFKURQL]DNLRO WR \V\WHP WLPH 7KH PRELOH W\HHSKROHV FDOQRW FRPPXQLFDWH LQ WKH \V\WHP XONLO WKH\ KDYH HWDEOLVKHG \VQFKURQL]DNLRO ZLWK WKH UHFHLYHG VSUHDG VSHFWXP HQ FRGHG ZDYHIRUP 80LNH WKH PRELOH W\HHSKROHV RQFH WKLV \VQFKURQL]DNLRO KDV RFFXUHG WKH 3U FLV &H KDV DQ RI WKH LQIRUPD WLRQ WKDW LW QHHGV WR SHUIRUP LW IXQFWLRQ RI GHQYHULQJ DFFXUDWH 87& WLPH WR D KRWW \V\WHP 7KH PRELOH W\HHSKROH PXW GHFRGH PXFK PRUH LQIRUPD WLRQ HWDEOLVK WZR ZD\ FRPPXQLFDWLRQV ZLWK WKH EDVH WDWLRO DQG EH D SDLG VXEVFULEHU WR SHUIRUPV LW IXQFWLRQ RI SDFLOJ DQG UHFHLYLOJ FDOQ

Spread spectrum modulation allows near perfect extraction of the timing information. We call it 'indirect GPS'.

\$OO RI WKLV PHDQV WKDW GXULQJ QRUPDO RSHUDWLRQ WKH TXDUW RI WKH WLPLOJ LQIRUPDWLRQ EHLQJ WDOQVPLW\HG IURP HDFK RI WKH EDVH WDWLROV LV YLW\XDOO D UHSHDW RI WKDW GLUHF\W REWLODEOH IURP WKH *36 7KH ELJ GLIHUHQFH LV WKDW WKH UHFHLYHG V\JQDQV W\HHSKROHV IURP WKH EDVH WDWLROV DUH D PLQLPXP RI G% ODJHU WKDQ WKRVH IURP WKH *36 WDWLROV ZKLFK LV ZK\ \RX FDO XVXDOO WDOQ RQ \RXU FHO SKROH LOGRRUV ' XH WR WKH ODWUH RI WKH ,6 VSUHDG VSHFWXP &' O\$ PRGXODWLRQ VFKHPH WKLV WLPLOJ LQIRUPDWLRQ PD\ EH H[WUDF\HG E\ D ZHO GHV\JQH UHFHLYHU ZLWK D SUHFVLRQ RI D IHZ ODQVHFROGV DQG WKH XQGHUOLJ IUHTXHQF\ WDELO\W RI WKH &' O\$ EDVH WDWLRO WDOQVPLWLRQV PD\ WKHUHE\ EH UHSURGXFHG DV ZHO 7KH 3U FLV &H GRHV \XW WKDW DQG IRU WKLV UHVRQ ZH FDO RXU W\HFKQRORJ\ \QGLUHF\ *36.

1 RWHV

Hardware Integration

KLV FKDSIHU ZL00 JXLGH \RX WKURXJK WKH PRWV EDVLF SK\VLFD0 LQWHJUDWLRQ DOG FKHFNRXW RI WKH 3U FLV &H 6XEVTXH0W FKDSIHUV DOG DSSHQGLFHV ZL00 JLYH \RX WKH LQIRUPDWLRQ QHHGHG WR FROILJXUH \RXU VRIWZDUH DOG KDUGZDUH IRU WKH PD[LPPXP SHUIRUPDQFH LQ \RXU RSHUDWLRQ HOYLURQPH0W

Checking and Identifying the Hardware

8QSDFN DOG FKHFN D00 WKH LWHPV XVLOJ WKH IR00RZLOJ FKHFN 0LW &R00DFW WKH IDFWRU\ LI DQ\WKLOJ IV PLWLOJ RU GDPDJHG

7KH 3U FLV &H +DUGZDUH 3DFN SDUW RU YDULDQW FROWDLQV

- 3U FLV &H 2(O ERDUG SDUW YDULDQW HMF

\$QWHQQD 2SWLROV

- +HQLFD0 DQWHQQD SDUW
- ODJQHILF PRXQW DQWHQQD FDE0H DWHPE0\ SDUW

Præcis Ce Physical Description

- \$QMHQQD -DFN

7KLV ULJKW DOJQH 60\$ FROQHFWRU MDFN
PDWHV ZLWK WKH DQMHQQD RU ZLWK WKH
FDEGH IURP WKH H[VHUQDO DQMHQQD

6:)DFWRU\ ' HIXXOW 5HVVRUH %XVWRQ

7KLV KRUL]RQWDO\ DFIXDWHG PRPHQ
WDO\ SXVKEXVWRQ VZLWFK LV XVHG IRU UH
VWRULQJ WKH IDFWRU\ GHIXOW VHWVLOJV

- +RVW ,QMHUIDFH +HDGHU

7KLV SIQ μ SWFK GXDO URZ
KHDGHU SURYLGHV WKH SRZHU LOSXW VH
ULDQ , 2 RSHQ FROO HTFH HTJ. 08 0 TQV)Tj. 08 0 TQV)Tj. 8

Host Interface Signal Descriptions

- 3LQ) XQFWLRQ
	1 &
	* URXQG
	<p> O336 6TXDUHZDYH RXWSXW 77/ /HYHΩ GULYH FDSDEOH ,I QRW XVHG QHDYH XQFRQQHFWHG 7KLV RXWSXW LV DQ RSWLRQ </p>

Hardware Interfacing Considerations

Mounting the Præcis Ce

7KH KRWW SULQWHG FLUFXLW ERDUG 3&% RU FKDWLV VKRXOG DFFRPPRGDWH PRXQWLQJ RI WKH 3U FLV &H XVLOJ WKH IRXU DFFHWLEOH PRXQWLQJ KRQHV ZKLFK DUH VL]HG IRU VFUHZV DOG μ URXQG RU KH[VSDFHUW RU WDOGRHIV \$ ILIWK PRXQWLQJ KRQH H[LWW EXW LV QRW XVHDEOH GXH WR WKH SODFHPHQW RI WKH 5) HOHFWRUPDJQHILF VKLHOG

Connecting to the Præcis Ce

,GHDO\ WKH KRWW 3&% VKRXOG EH GHVLJQHG ZLWK D SLO GXDO URZ IHPDOH KHDGHU SURS HUL\ ORFDWHG DOG RULHQWHG ZLWK UHVSHFW WR WKH 3U FLV &H PRXQWLQJ WDOGRHIV VR WKDW LW ZLOO PDNH ZLWK - WKH GXDO URZ PDOH KHDGHU RQ WKH 3U FLV &H ZKHQ LW LV PRXQWHG WR WKH WDOGRHIV \$OHUODWLYHO\ D ULEERO FDEOH FRXOG EH XVHG WR PDNH WKH FROQHFWLRQ ' XH WR WKH KLJK VSHHG WUDQVWUROV RI VHYHUDO RI WKH VLJODV RQ WKH LQIHUIDFH WKH OHQJWK RI VXFK ULEERO FDEOH VKRXOG EH NHSW DV VKRUW DV SRVLEOH DOG LQ QR FDVH VKRXOG LW EH OROJHU WKDO DERXW RU FP

7\SLFDO\ WKH KRWW FKDWLV VKRXOG EH FROILJXUHG ZLWK DO 60\$ EXONKHDG MDFN WR DFFR PRGDWH WKH 3U FLV &H DQWHOOD 7KH DQWHOOD HULWKHU WKH KHOLFDO RU WKH PDJQHILF PRXQW DQWHOOD FDEOH DWHPDO\ VKRXOG EH FROQHFWHG WR WKH H[WHULRU VLGH RI WKLV FKDWLV PRXQWHG EXONKHDG MDFN ' HSHQGLOJ XSRO WKH LQWHQG HG PRXQWLQJ RULHQNDLRO RI WKH KRWW FKDWLV D ULJKW DOJH 60\$ DGDSWHU PD\ EH OHHG HG WR YHUNLFDO\ RULHQW WKH KHOLFDO DQWHOOD \$ VKRUW FDEOH ZLOO EH OHHG HG WR URXWH WKH DQWHOOD VLJQDO IURP WKH LQIHULRU VLGH RI WKH FKDWLV PRXQWHG EXONKHDG MDFN WR WKH 3U FLV &H DQWHOOD LOSXW MDFN

Functional Checkout of the System

8VLQJ DO HYDOXDNLRO XQLW \RX VKRXOG KDYH SUHYLRXVO\ YHULIHG FHOOXODU &' O\$ VLJQDO DYDLODELO\ LQ \RXU ODERUDWRU\ 7KH FKHFNRXW SURFHGXUH GHVFULEHG KHUH LV LQWHQG HG WR YHULI\ FRUHFWRU FROILJXUDNLRO RI \RXU KRWW V\WHHP LQIHUIDFH WR WKH 3U FLV &H DV ZHOO DV SURSHU RSHUDNLRO RI WKH 3U FLV &H LWHOI 8VLQJ WKH WZR RSHQ FROHFWRU WDWXV RXWSXW DOG RU WKH VHULO , 2 SRUW WKH JHQHUDO YHULIFDNLRO SURFHGXUH FROVLVW RI WKHVH WHSV

6FUHZ WKH DQWHOOD KHOLFDO RU PDJQHILF PRXQW DQWHOOD FDEOH DWHPDO\ RQWR WKH KRWW FKDWLV DQWHOOD LOSXW MDFN 7KH DQWHOOD VKRXOG EH RULHQWHG YHUNLFDO\ DOG EH XQREVWUXFWHG E\ ODUJH PHNDOLF VXUIDFHV FORVHU WKDO D IHZ PHWHUW

3RZHU XS WKH KRWW V\WHHP

ORQLWRU WKH \$ODUP DOG 7LPH /RFN RSHQ FROHFWRU RXWSXW IURP WKH 3U FLV &H ,I WKH KRWW V\WHHP LV FROILJXUHG WR SXOO XS WKHVH RXWSXW XVH D YROWPHWHU RUKHUZLVH XVH DO RKPPHWHU WR GHWHUPLQH WKH WDWXV RI WKHVH RXWSXW

ORQLWRU WKH VHULO , 2 FKDUDEFWHUW UHFHLYHG IURP WKH 3U FLV &H YLD DO\ PHDOV ZKLFK \RX PD\ KDYH LQ \RXU GHYHORSPHQW HOYLURQPHQW

RXWSXW LV HWHQWLDQ\ WKDW RI WKH RQ ERDUG WHPSHUDWXUH FRPSHOVDIHG FU\WDO RV
FLOODIRU

\$W\WKLV SRLOW WKH XQLWLV IXQ\ \QFKURQLJHG ,I \RX DUH XQDEOH WR YHUL\ WHSV ² WKHQ
\RX PXVW WURXEHVKRRW \RXU LQWHUIDFH WR LVRODWH WKH IDXW WR HLWKHU D GDPDJHG RU GHIF
WLYH 3U FLV &H RU DQ HUURU LQ WKH LQWHUIDFH FROILJXUDWLRQ

,I \RX DUH DEOH WR YHUL\ WHSV ² EXW DUH XQDEOH WR YHUL\ WHSV ² ZLWKLO WZHQN
PLOXIVH \RX VKRXOG PRYH WKH DQWHOOD DOG RU FKDOJH LW RULHQDWRU DOG UH WJ\

,I, I, XUD

Serial I/O Control and Status Commands

KLV FKDSWHU GHV FULEHV WKH \$6&,, SURWRFRO VXSSRUWHG E\ WKH 3U FLV &H ,Q DGGL WLRQ WR WKH 3U FLV &H QDILYH FRPPDQGV WKH HPXODWLRQ PRGHV ZKLFK HODEOH XVH RI WKH 3U FLV &H ZLWK H[LWLOJ SXEOLF GRPDLQ GULYHUV IRU YDULRXV RSHUDWLOJ V\WHHPV DQG SODWRUPV DUH GHV FULEHG 7KH VHULDO , 2 SRUW SK\VLFDQ DQG HOHFUL FDQ FKDUDFWHULVLFV DUH GHILQHG DV ZHO

General Serial I/O Operation

7KH 3U FLV &H DFFHSW LQSXW FRPPDQGV WKDW DUH WHUPLQDWHG ZLWK HLUKHU DQ \$6&,, &DU ULDJH 5HGXUQ &75/ O [\$ FROWRO FKDUDFWHU GHORWHG E\ &5! RU DQ \$6&,, &DU ULDJH 5HGXUQ &75/ O [\$ /LQ)HHG &75/ - [' SDU RI FROWRO FKDUDFWHU GHORWHG E\ &5! /)! &RPPDQGV DUH QRW FDUH VHOVLWLYH 7KH 3U FLV &H WHUPL QDWLV DQ WDWXV PHWDJHV WKDW LW VHQGV LQ UHVSRQVH WR FRPPDQGV ZLWK D &5! /)! SDU 7KH 3U FLV &H GRHV QRW HFKR DQ XVHU LQSXW

7KH 3U FLV &H UHVSROGV WR LOYDQ FRPPDQGV ZLWK

(5525 &5! /)!

1XPULFDQ LQSXW DUH DFFHSWHG LQ DQ WDOGDUG IRUPDW)RU H[DPSOH DQ RI WKHVH IRU PDW DUH DFFHSWDEOH IRU WKH GHFLPDQ OXPEHU

(H (

\$W SRZHU XS ZLWK IDFWRU\ GHIDXW VHWOLOJV WKH 3U FLV &H RXWSXW D WLPH RI GD\ PHWDJH RQFH SHU VHFROG 7KH IDFWRU\ GHIDXW HPXODWLRQ PRGH LV 121 (DQG WKH 3U FLV &H VHQGV WKH WLPH RI GD\ PHWDJH LQ LW QDILYH IRUPDW 6HH &RFN (PXODWLRQ ORGHV IRU GH WLOLW RQ WKHVH IRUPDW

Detailed Command Descriptions

CAL

7KLV FRPPDQG DORZV WKH XVHU WR TXHU\ DOG VHW WKH YDOXH RI D FDLEUDWLRQ RIIVHW WKDW WKH 3U FLV &H FDQ PDNH WR WKH 3U FLV &H WLPLOJ RXWSXW ,W FDQ EH XVHIXO IRU FRPSHOVDW LOJ YDULRXV GHOD\ SUHVHQRW LQ D \V\WHP 7KH XQLW IRU WKH RIIVHW DUH VHFROGV 7KH DORZ DEQH UDOJH LV VHFROGV WR VHFROGV ZKHUH D SRVLWLYH FDLEUDWLRQ RIIVHW PHDQV WKDW WKH 3U FLV &H WLPLOJ RXWSXW ZLOO EH DGYDQFHG LQ WLP 7KH 3U FLV &H SHU IRUPV WKLW DGXVWPHQW ZLWK D UHVROXWLRQ RI DSSUR[LPDWH\ QDQRVHFROGV 7KH H[DPSOH UHVSROVH LQGLFDWHV WKDW WKH RXWSXW DUH FXUUHQW\ UHNDUGHG E\ PLFURVHF RQGV UHODWLYH WR 87& DV UHFHLYHG IURP WKH &' O\$ EDVH WDWLRO

,Q XUEDQ DUHDV GLVNDQFHV WR EDVH WDWLROV VKRXOG QRUPDOO\ EH OHW WKDQ WZR PLOHV ,W FRXOG PDNH VHOVH WR VHW WKH FDLEUDWLRQ RIIVHW WR SHUKDSV PLFURVHFROGV KDOI RI WKH DSSUR[LPDWH QJKW VSHHG WUDQVW WLP RYHU WZR PLOHV WR LPSURYH WKH DEVROXW\ DFFXUDF\ RI WKH 3U FLV &H ,I \RX KDYH VRPH ZD\ RI NORZLOJ KRZ IDU WKH FORVHW EDVH WDWLRO LV IURP \RXU V\W\ \RX FRXOG PDNH D PRUH HGXFDPHG DGXVWPHQW XVLOJ WKH DSSUR[LPDWH SURSDJDWLRQ GHOD\ RI RQH QDQRVHFROG SHU IRRW RU QDQRVHFROGV SHU PHWHU DOG WKH &\$/ FRPPDQG 6HW YDOXH LV UHNDLQHG LQ ORQ YRODWLQ\)/\$6+ PHPRU\

Usage:

```
4XHU\          &$/ &5! /)!
3U FLV &H UHVSROVH          &5! /)! X
```


21 75,0%/(DOG DMIHPSIW WR FKDOJH WKH VNDWXV XVIQJ WKH (9(17 FRPPDOG UH
FHLYH WKH UHVSROVH 9(5525 &5! /)! · DOG DUH LJQRUHG ,I &7,O(LV 21 LW RXW
SXW VDNHV SULRULV RYHU WKHVH HYHOW WLPHNDJV ,WLV UHFRPPHOGHG WKDW &7,O(EH WXUOHG
2)) GXULQJ HYHOW WLPHNDJLQJ RSHUDLRO 5HIHU WR \$\$\$SHOGL [& ² 7HFKQLFDO 6SHFLILFDLROV
IRU HYHOW WLPHNDJLQJ LPSOHPHQWDLRO GHNDLQV

Usage:

4XHU\ (9(17 &5! /)!
3U FLV &H UHVSROVH 2)) &5! /)!
6HW (9(17 21 &5! /)!
3U FLV &H UHVSROVH 2. &5! /)! 7KHQ DQ (YHOW 7LPH PHWDJH ZLQO EH
VHOW IRORZLQJ HDFK SRVLWLYH WJDOVLRO RI WKH &76 VH
ULDQ , 2 LOSXW VLJQDO 7KH (YHOW 7LPH PHWDJH IRU
PDWLIV

7 <<<< ' ' ' ++ 00 66 VVVVVVVV]== P &5! /)!

6HH WKH QDILYH 3U FLV &H WLPH RI GD\ PHWDJH IRUPDW
IRU WKH GHILQLRO RI HDFK RI WKHVH FKDUDFWHU ILHOGV
7KH (YHOW 7LPH PHWDJH GLIHUV ROQ\ IQ WKDW WKH 7
FKDUDFWHU LV QRW RO WLPH DOG IQ WKH DXJPHQWDLRO RI
WKH VHFROGV ZLWK D GHFLPDO SRLQW DOG QLOH GLJLW
VVVVVV RI VXE VHFROG LQIRUPDLRO

Factory Default Setting:

2))

FLTSTAT

7KLV TXHU\ ROQ\ FRPPDOG GLVSOD\V WKH FXUUHOW VXPPDU\ VNDWXV RI WKH 3U FLV &H 7KH
VXPPDU\ VNDWXV LV FROMDLQHG IQ VL[VHHQ ELW ZKLFK DUH GLVSOD\HG IQ IRXU KH[DGHFLPDO
FKDUDFWHU\ \$VHWLRO RI DO\ RI WKHVH ELW ZLQO DQVH EH LOGLFDWHG E\ WKH \$ODUP 2SHQ
&ROHFIRU RXWSXW VDIH FKDOJLQJ WR WKH KLJK LPSHGDOFH 7KH (9(17 21 &5! /)! 7HFKQLFDO 6SHFLILFDLROV

PORT

7KLV FRPPDQG DORZV WKH XVHU WR TXHU\ DQG VHW WKH FXUUHQW VHULDO , 2 SRUW VHWLQJ &KDOJHV WR WKH VHWLQJ WDNH SODFH LPPHGLDWH\ DQG DUH UHNDLQHG LO QRO YRODVLQ)/\$6+ PPHRU\ <RX PXW FKDOJH \RXU WHUPLDO SURJUDP WR PDWFK WKH VHWLQJ LO RUGHU WR FROMLQXH WR FRPPXQLFDWH ZLWK WKH 3U FLV &H 5HVSROQH WKH IDFWRU GHIDXOW VHWLQJ PD\ EH QHFHVVDU\ VKRXOG \RX IRUJHW WKH FXUUHQW VHWLQJ 6HH \$SSHQGL[% 2)DFWRU ' GHIDXOW 5HVSROH %XWURO IRU GHNDLOV RO UHVSROQH WKH IDFWRU\ GHIDXOW VHWLQJ 7KH EDXG UDWH QXPEHU RI GDWD ELW SDULN DQG QXPEHU RI WRS ELW PD\ EH VHW

%DXG UDWH PD\ EH
 1 XPEHU RI GDWD ELW PD\ EH RU
 3DULN PD\ EH (HYHQ 2 RGG RU 1 QROH
 1 XPEHU RI WRS ELW PD\ EH RU

Usage:

4XHU\ 3257 &5! /)!
 3U FLV &H UHVSROQH 1 &5! /)!
 6HW 3257 R &5! /)!
 3U FLV &H UHVSROQH 2. &5! /)!

Factory Default Setting: 1

PPSWIDTH

7KLV FRPPDQG DORZV WKH XVHU WR TXHU\ DQG VHW WKH FXUUHQW 336 RXWSXW SXOVHZLGMK 7KH YDOXH LV LO XQLW RI PLOLVHFROGV DQG PD\ EH WR

Usage:

4XHU\ 336: , ' 7+ &5! /)!
 3U FLV &H UHVSROQH &5! /)!
 6HW 336: , ' 7+ &5! /)!
 3U FLV &H UHVSROQH 2. &5! /)!

Factory Default Setting:

REACQUIRE

7KLV FRPPDQG DORZV WKH XVHU WR IRUFH DORWKHU VLJQDO SURFHWRU DFTXLVLVRO VHTXHQFH DQG LV JHOHUD\ RO\ XVHG LO VLJKW\ HPEHGHHG VVWHPV 7KLV ZLOO FDXVH WKH XQLW WR 10 ZKHQ XQWLO LW UHDFTXLUHV D VLJQDO

Usage:

4XHU\ 6(77, 1*6 &5! /)!
 3U FLV &H UHVSROVH &DO &5! /)!
 &WLPH 2)) &5! /)!
 (PXO 121(&5! /)!
 (YHQW 2)) &5! /)!
 3RUW 1 &5! /)!
 336: LGWK &5! /)!
 7PRGH 87& &5! /)!

6HW 1 \$
 3U FLV &H UHVSROVH 1 \$

Factory Default Setting: 1 \$

SPSTAT

7KLV TXHU\ RO\ FRPPDQG GLVS\V WKH FXUHQW VDWXV RI VHQHFWHG V\JDO SURFHVVU SD
 UDFHWHU 7KLV LV D IL[HG QHQJWK PHWDJH IRUPDWHG DV VR

636 &+\$1 312 \$* & 9&' \$& 61 5) (55 &5! /)!

: KHUH

636 LV WKH 6LJDO 3URFHVVU 6NDH ROH RI \$&4 \$FTXULQJ ' (7 6LJDO
 ' HWHFWHG /. * &RGH /RFNLQJ 7. * &DUULHU /RFNLQJ /. '
 /RFNHG

&+\$1 LV WKH &' O\$ IUHTXHQF\ FKDQHO EHLQJ XVHG)RU 1 RUMK \$PHULFDO
 IUHTXHQFLV WKH UHSRWHG FKDQHO ZLOO EH 35,\$ 35,% 6(&\$ RU
 6(&% 7KHVH WDOG IRU 3ULPDU\ \$ 3ULPDU\ % 6HFROGDU\ \$ RU 6HFRO
 GDU\ % FKDQHOV)RU . RUHQ IUHTXHQFLV WKH UHSRWHG FKDQHO ZLOO EH
 35. \$ 35. % 6(. \$ RU 6(. % 7KHVH WDOG IRU 3ULPDU\ \$ 3ULPDU\
 % 6HFROGDU\ \$ RU 6HFROGDU\ % FKDQHOV)RU ,QGLDQ IUHTXHQFLV WKH
 UHSRWHG FKDQHO ZLOO EH RU
 , 7KHUH DUH PXQLSOH SULPDU\ DQG VHFROGDU\ FKDQHOV LQ WKH ,QGLDQ
 FKDQHOVHW VR WKH FKDQHO OXPHEU LV EHLQJ XVHG

312 LV WKH EDVH WDWLRO 3VHXGR1 RLVH 2IVHW WR LQ XQLW RI 3VHX
 GR1 RLVH FRGH FKLSV

\$* & LV WKH \$XWRPDULF *DLQ &RQWRO ' \$& EVNH WR ZLWK ODUJHU OXP
 EHUV LPS\NLQJ KLJKHU 5) JDLO 7\SLFDO UDQJH LV WR

9&' \$& LV WKH 7&; 2 9RWDJH &RQWRO ' \$& ZRUG WR ZLWK ODUJHU
 OXPHEUV LPS\NLQJ KLJKHU 7&; 2 IUHTXHQF\ 7\SLFDO UDQJH LV WR

87& 7KH 87& VHWLQJ ZLOO FDXVH WKH WLPH RI GD\ WR EH GLVSOD\HG DV 87&
WLPH 87& WLPH LV * 36 WLPH ZLWK WKH DGGWLRQ RI QHDS VHFROGV /HDS
VHFROGV FDO EH GHWHUPLQHG E\ WKH XQLW DXWR

Spectracom

7KLV LV : : 9%)RUPDW DOG LW LV VHQW RQFH HDFK VHFROG ZLWK WKH QHDGLOJ &5! EHLQJ
WKH RQ WLPH FKDUDFWHU ZKLFK LV VHQW GXULQJ WKH ULVW PLQLVHFROG RI HDFK VHFROG 7KH
WLPH PRGH LV DOZDV 8

OO LV WKH PLOXNH RI WKH KR XU
66 LV WKH VHFROG RI WKH PLOXNH
4 LV WKH 7LPH 4XDQ\N FKDUDFWHU DOG PD\ EH ROH RI WKH IRORZLOJ
" LOGLFDWHV WKH XOV\QFKURQLJHG FROGLILRO
LOGLFDWHV HUURU PV
LOGLFDWHV HUURU PV
LOGLFDWHV HUURU PV
LOGLFDWHV HUURU PV VSDFH FKDUDFWHU

Time Figure of Merit/Time Quality

7KH ODWLYH DOG HPXODWHG WLPH RI GD\ PHVDJHV VHOW E\ WKH 3U FLV &H FROMDLO D FKDUDF
WHU WKDW LOGLFDWHV WKH OHYHO RI DFFXUDF\ WKDW VKRXOG EH LOFOXGHG IQ WKH LQWHUSU

1 RWHV

Factory Defaults Restore Button

KH)DFWRU\ ' HIDXOW 5HVMRUH %XWWRQ 6: LV ORFDWHG RQ WKH VDPH HQG RI WKH 3U FLV &H ZKHUH WKH DQWHOOD LQSXW IDFN - LV PRXQWHG ,W LV D KRUL]RQWDO\ DFWXQWHG PRPHQWU\ VZLWFK \$ QRQ FROGXFWLQJ VPD00 GLDPHWHU EOXQW WRR0 LV D JRRG ZD\ WR GHSUHW WKH EXWWRQ

Caution

' R QRW XVH DQ H[FHWLYH DPRXQW RI TRUFH LQ GHSUHWLQJ WKH)DFWRU\ ' H IDXOW 5HVMRUH %XWWRQ ' DFDJH WR WKH VZLWFK DQG RU LW FROQHFWLRQ WR WKH SULQWHG FLUFXLW ERDUG FRXOG UHVXOW IURP VXFH H[FHWLYH SUHVXUJ

Restoring Factory Default Settings

6KRXOG \RX ZLVK WR UHVHW WKH)DFWRU\ ' HIDX UHVXFWLQJ WRR0

1 RWHV

Upgrading the Firmware

HULRGLFD00\ (QG5XQ 7HFKQR0RJLHV ZL00 PDNH EXJ IL[HV DQG HOKDQFHPHQW WR
RXU SURGXFW DYDLODECH IRU GRZQORDG IURP RXU ZHEVLWH \$00 VXFK GRZQORDGV DUH
IUHH0\ DYDLODECH WR RXU FXVWRPHUV ZLWKRXW FKDUJH \$1WHU \RX KDYH GRZQORDGHG
WKH DSSURSULDWH)/\$6+ ELODU\ LPDJH ILOH \RX DUH UH DG\ WR SHUIRUP WKH XS
JUDGH WR \RXU 3U FLV &H

What You Need To Perform the Upgrade

<RX ZL00 QHHG D WHUPLDO SURJUDP ZKLK VXSSRUW ILOH XSORDGLOJ XVLOJ WKH ; 02' (0
. SURVRFRO ZLWK &5& 7KLV LV GRR0 R24100 T(4) 8) 080 T(0) T2. 52 0

Performing the Upgrade

&ROIJXUH \RXU WHUPLQDO SURJUDP DOG WKH 3U FLV &H WR FRPPXQLFDWH DW WKH GHVLJHG EDXG UDWI E\ XVLOJ WKH VHWLOJV IDFLOLW IRU \RXU WHUPLQDO SURJUDP DOG WKH SRUW FRP PDQG IRU WKH 3U FLV &H 5HIHU WR &KDSWHU 6HULO , 2 &RQWURO DOG 6NDWKV &RPPDQG IRU GHNDLW RQ XVLOJ WKH SRUW FRPPDQG

\$ IWHU HWDEOLVKLOJ FRPPXQLFDLROV ZLWK WKH 3U FLV &H XVLOJ WKH GHVLJHG SRUW VHWLOJV LWXH WKH IRORZLOJ FRPPDQG WR LQILDLWH WKH XSORDG

XSORDG &5! /)!

\$ IWHU LWXLOJ WKLW FRPPDQG \RX ZLOO VHH WKH 3U FLV &H UHVSROG ZLWK WKLW PHVVDJH

: DLWLQJ IRU GRZQORDG XVLOJ ; 02' (0 . ZLWK &5&
&RQWURO ; ZLOO DERUW GRZQORDG
&&&<

<RX ZLOO WKHQ VHH WKH 3U FLV &H VHOG WKH FKDUDFWHU 1&. HYHU\ WKHU VHFRQV ZKLOH LW LV ZDULQJ IRU \RX WR EHJLQ XSORDGLQJ WKH LPDJH ILOH 6KRXOG \RX QHHG WR DERUW WKH XSORDG SURFHV QRZ VHOG &75/ ; WR WKH 3U FLV &H ,I \RX DERUW DW WKLW WLPH \RXU FXUUHQW ILUPZDUH ZLOO UHPDLQ LQDFW ,I \RX DERUW DIWHU WKH ILOH WUDQVHU LV LQ SURJUHWW \RX ZLOO QRW UHNDLQ \RXU RULJLQDO ILUPZDUH <RX ZLOO QHHG WR UH XSORDG LW

ZWKHUZLVH VDUW WKH XSORDG XVLOJ WKH DSSURSULDWH PHWKRG IRU \RXU WHUPLQDO SURJUDP ' XULQJ WKH XSORDG \RXU WHUPLQDO SURJUDP ZLOO GLVSOD\ VRPH VRUW RI VNDWV LOGLFDLRO ,I WKH XSORDG LV VXFFHWIXO \RX ZLOO VHH WKH 3U FLV &H UH ERRW GLVSOD\LOJ WKH ILUPZDUH YHUVLRO LQIRUPDLRO ZKHQ LW GRHV 1 RIH WKH ILUPZDUH YHUVLRO LQIRUPDLRO DW WKLW WLPH DOG YHUL\ WKDW LW LV LOGHHG WKH ILUPZDUH WKDW \RX LQWHQG WR XSORDG WR WKH 3U FLV &H ,I LW LV \RX KDYH VXFFHWIXO\ XSJUDGHG WKH ILUPZDUH LQ \RXU 3U FLV &H

Problems with the Upload

6KRXOG \RX KDYH GLILFXOWLV ZLWK WKH XSORDG GXH WR D FRUUXSW ILOH SRZHU IDLOXUH GXULOJ XSORDG RU RWKHU DFFLGHQW GR QRW EH DODUPHG (YHQ WKRXJK \RX PD\ KDYH QRW WKH H[

400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500

ZDNFKGRJ LQWLDWHG UH ERRW 7KLV SURFHW ZL00 EH UHSHDWHG LQGHILQWHD\ XQOHW \RX LQWHU YHQH

)RU ERRWORDGHU YHUVLROV DOG HDUOLHU ,I WKH ERRW ORDG DSSQDFNLRO ODXQFK VHTXHOFH DSSHUV WR EH FDXJKW LQ D ORRS KROG GRZO WKH ¶E· NH\ RQ \RXU NH\ERDUG ZKLOH WKH ERRW ORDGHU LV FRPLQJ XS 7KLV ZL00 FDXVH WKH ERRW ORDGHU WR LJQRUH WKH SUHVHOFH RI ZKDW LW WKLQNV LV D YDQG DSSQDFNLRO SURJUDP LQ)/\$6+ DOG IRUFH WKH ERRW ORDGHU WR LQWLDWH WKH ; O2' (O XSORDG VHTXHOFH : KHQ \RX VHH WKH FKDUDFWHU ¶&· EHLQJ GLVSOD\HG HYHU\ WKUHH VHFROGV \RX PD\ LQWLDWH WKH XSORDG RI D QHZ DSSQDFNLRO SURJUDP ILQH

)RU ERRWORDGHU YHUVLROV DOG ODWHU ,I WKH ERRW ORDG DSSQDFNLRO ODXQFK VHTXHOFH DSSHUV WR EH FDXJKW LQ D ORRS W\SH 'UHFRYHUµ ULJKW DINHU WKH ERRWORDGHU YHUVLROV WUOLQJ LV GLVSOD\HG 7KLV ZL00 FDXVH WKH ERRW ORDGHU WR LJQRUH WKH SUHVHOFH RI ZKDW LW WKLQNV LV D YDQG DSSQDFNLRO SURJUDP LQ)/\$6+ DOG IRUFH WKH ERRW ORDGHU WR LQWLDWH WKH ; O2' (O XSORDG VHTXHOFH : KHQ \RX VHH WKH FKDUDFWHU ¶&· EHLQJ GLVSOD\HG HYHU\ WKUHH VHFROGV \RX PD\ LQWLDWH WKH XSORDG RI D QHZ DSSQDFNLRO SURJUDP ILQH

1 RWHV

Technical Specifications

5HFHLYHU

&H00X0DU ORELOH 5HFHLYH %DQG 2 O+]
7,\$ (,\$,6 &' O\$ 3LORW DQG 6\QF FKDQQH0V

\$QWHQQD

6O\$ EXONKHDG M0FN - =_{in} Ω O+] ô ZDYH KHOLFDO VMDQG DUG 5HPRWHO\
PRXQWDEOH PDJ0HMLF EDVH DQWHQQD FDEOH DVVHPEO\
RSMRQDO

/RFD0 2VFLOODWRU 2SMRQDO 7&; 2 RU 2&; 2
7LPH WR /RFN PLOXWHV W\SLFDO

336 7LPLOJ &KDUDFWHULVMLFV

ZKHQ XQLW LV SURWHFWHG IURP DLU FXUUHQW

- \$FFXUDF\
PLFURVHFROGV WR 87& W\SLFDO ZKHQ 0RFNHG)ULQJH DUHD UHFHSMRQ
PD\
GHJUDGH WKH DEVROXWH MLPLQJ DFFXUD

