HOW TO:

A Blackbox Handbook

to

Synthetic Programming Techniques

with the

HP—41C

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PREFACE.

This book is designed to teach the person who has
neither the time nor the inclination to learn how the
4iC goes about carrying out various non — standard
techniques, but explains in detail (step by step
instructions), how to use these techiques.

My sincere thanks go to Assoc. Prof. John Mc Gechie (3324),
& Jim Trainor (1390) for passing on the knowledge that
allows me to write this book & to Fred Roche (2324),
Richard Collett (4523), Tom Steadman & George Seggie for
proof reading & thoroughly testing the procedures herein.
In both Tom & George's instance, neither gentleman was
familiar with these procedures & consequently learnt from
the text as they worked through it.

N.B.

This book requires the reader to have a copy of the
following:
1. "KA" — A Key Assignment Program.
2. "NN" — A Non — Standard Character generator from Decimal
   Number inputs.
3. "little b2" — A routine that places non — standard text
                 into programs.
4. "Hex Chart"; P.P.C. Journal V.6. N.5. P.22 & 23.

Copies of the above & any information relating to this book
can be obtained from the author:

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A. <u>Create a Byte — Jumper using "KA" a Key Assignment</u>
<u>Program !!</u> If you haven't a Card Reasder see "Part 2".

XEQ "KA", when "Key 1" appears in display, key in 241
Enter up, 65 Enter up, & the keycode of the key you wish
to assign the Byte — Jumper to, e.g. key 11 = $\sum$ + key,
key —11 = the shifted $\sum$ + key, key 12 = 1/x key etc. then
press R/S. When "Key 2" appears in display, your first
assignment has been made; now proceed to one of the
following sections.

B. Create a Non — Standard Text Line using the Byte — Jumper !!
   1. Have you carried out Section "A" if not go back & do so.
   2. Go into program mode, at line where non — standard text
      is required.
   3. Key in an x<>y instruction; then in Alpha mode the text
      "AB".
   4. Go into run mode & in user mode, press the key to which
      you assigned the Byte — Jumper (hereafter referred to as
      "Byte — Jump").
   5. Go back into program mode & see:— [—   ]
   6. In Alpha mode, key "ABCDE" (No. of letters = No. of
      characters in required text line).
   7. Come out of Alpha mode & BST, see x<>y, SST, see "A▨ ".
   8. SST 5 steps (= to the No. of letters keyed in, in step 6),
      delete these steps placing the "A▨ " in view.
   9. Now refer to the Hex Chart, & select the "stand alone"
      instructions (directly below the centre character) that
      equal each character of your required text line.
   10. Come out of user mode & key in your "stand alone"
       instructions, (if any deletions/changes are made you
       must then XEQ "PACK").
   11. BST to the "A▨ ", then go into run mode & in user mode,
       Byte — Jump. Go back into program mode & see:— [—   ]
   12. Key in a "+" instruction; BST, see x<>y, SST, see "A▢ ",
       SST again & see the required text line. BST & SST
       deleting the unwanted instructions from around you non —
       standard text line.
   N.B. Note that line numbers are disturbed by Byte — Jumping.
         GTO Lbl or GTO.nnn will correct this.

C. Create a Null or Nulls in a Non — Standard Text Line using
   the Byte — Jumper !!

   1. Have you carried out Section "A" if not go back & do so.
   2. Go into program mode, at line where non — standard text
      is required.
   3. Key in an x<>y instruction; then in Alpha mode the text
      "AB".
   4. Go into run mode & in user mode, press the key to which
      you assigned the Byte — Jumper (hereafter referred to as
      "Byte — Jump").
   5. Go back into program mode & see:- | — |
   6. In Alpha mode, key in "ABCD" (No. of letters = No. of
      characters in required text line, including null or
      nulls).
   7. Then out of Alpha mode, BST, see x<>y, SST, see "A▨ ".
   8. SST 4 steps (= to the No. of letters keyed in, in step 6),
      then delete these steps, placing the "A▨ " in view.
   9. Now refer to the Hex Chart, & select the "stand alone"
      instructions (directly below the centre character) that
      equal each character of your required text line.
   10. Come out of user mode & key in your "stand alone"
       instructions, keying in a "+" instuction wherever a null
       (or nulls) is required, go into run mode & in user mode,
       Byte — Jump. If any deletions/changes are made you must
       then XEQ "PACK".
   11. BST to the "A▨ ", & as you go delete the "+"
       instructions where the null or nulls is required, go
       into run mode & in user mode, Byte — Jump.
   12. Place the machine back into program mode & see:- | — |
   13. Key in a "+" instruction; BST, see x<>y, SST, see
       "A▨ ", SST again & see the required text line. BST &
   SST deleting the unwanted instructions around your non —
       standard text line.

D. Create a 1 Byte NOP using the Byte — Jumper !!

   1. Have you carried out Section "A" if not go back & do so.
   2. Go into program mode, at line where 1 Byte NOP is required.
   3. Key in an x<>y instruction, then in Alpha mode the text
      "AB". Go into run mode & in user mode, press the key to
      which you assigned the Byte — Jumper.
   4. Come back into program mode, see:- — , key in "RCL IND T"
      instruction, BST, see x<>y, SST, see "A▨ ", SST again to
      see | T | , "a null string" = 1 Byte NOP.

D. N.B.   This one Byte Null String does not change the
            contents of the Alpha register.

5. BST & SST deleting the unwanted instructions around
   the 1 Byte NOP.

E. Create a Non – Standard Alpha Local Label using the
    Byte – Jumper !!

1. Have you carried out Section "A" if not go back & do so.
2. Go into program mode, at line where Non – Standard Alpha
   Label is required.
3. Key in an x⟨⟩y instruction, then in Alpha mode the text
   "AB".
4. Go into run mode & in user mode, press the key to which
   you assigned the Byte – Jumper, (hereafter written as
   "Byte – Jump").
5. Go back into program mode & see:- [_____]
6. Key in "Lbl 55" instruction, BST, see x⟨⟩y, SST see
   "A▨ ".
7. Then out of user mode key the "stand alone" instruction
   that is equal to the Alpha character required in your
   local label (you will find these instructions directly
   below the centre character on the Decimal 112 – 122
   row on the Hex Chart).
8. BST, placing the "A▨ " in view, go into run mode & in
   user mode, Byte – Jump.
9. Come back into program mode, see:- [_____]
10. Key in a "+" instruction, then SST to see your Non –
    Standard Alpha Local Label.
11. BST & SST deleting the unwanted instructions around
    your local label.

F. Create a 3 Byte – Non – Standard Instruction using the
    Byte – Jumper !! (e.g. GTO M).
1. Have you carried out Section "A" if not go back & do so.
2. Go into program mode, where the 3 Byte instruction is
   required.
3. Key in an x⟨⟩y instruction, then in Alpha mode the text
   "AB".
4. Go into run mode & in user mode, press the key to which
   you assigned the Byte – Jumper (hereafter written as
   "Byte – Jump"). Go back into program mode & see:- [_____]
5. Key in "GTO 99" instruction, BST, see x⟨⟩y, SST, see
   "A▨ ", SST again, see x ≠ ∅ ? (= to 99).
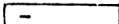
F. 6. Delete the x ≠ Ø ? & insert a 1 Byte filler e.g.
        (x⟨ ⟩y), then key in "RDN" instruction (= to M).
        BST & delete the 1 Byte filler (x⟨ ⟩y), thus
        placing the "A⊠ " in view.

    7. Go into run mode & in user mode, Byte – Jump, come
        back into program mode, see:– –

    8. Key in a "+" instruction, BST, see x⟨ ⟩y, SST to see
        "A⊡ ", SST again to see "GTO M".

    9. BST & SST deleting the unwanted instructions around
        your 3 Byte instruction.

        N.B. Many instructions on the HP – 41C are made from
              a number of "pieces", e.g. a 2 Byte store
              instruction (as defined in the operating
              manual) is made of a Prefix (STO), & a postfix
              (i.e. 25 or IND 21). The same coding can mean
              different things when the machine interprets it
              as a prefix or a postfix for example, if the
              coding for "STO" is immediately followed by the
              coding for x ≠ Ø?, then the two codes are
              interpreted as the instruction "STO 99" because
              the "stand alone" instruction "x ≠ Ø?" is equal
              to the postfix "99" in terms of machine coding.
              The whole aim of synthetic programming is to
              place "Non – Normal" (i.e. not normally
              keyable) postfixes after standard prefixes to
              create synthetic instructions which can save
              memory or allow otherwise impossible things
              to be done on your HP – 41C !

G. Create a 2 Byte Non – Standard Instruction using the
    Byte – Jumper !! (e.g. STO N).

    1. Have you carried out Section "A" if not go back & do so.

    2. Go into program mode, at line where 2 Byte non –
        standard instruction is required.

    3. Key in an x⟨ ⟩y instruction; then in Alpha mode the text
        "AB".

    4. Go into run mode & in user mode, press the key to which
        you assigned the Byte – Jumper (hereafter written as
        "Byte – Jump").

    5. Go back into program mode & see:– ⌞ –   ⌟

    6. Key in "STO 99" instruction, SST, see * , BST, see
        x ≠ Ø?

    7. Delete the x ≠ Ø? & then key in "Last X" instruction.

G. 8. BST, see "A ▨ ", go into run mode & in user mode,
       Byte Jump.

    9. Come back into program mode, see:- [-   ]

    10. Key in a "+" instruction, BST to see x⟨⟩y, SST,
        to see "A ▢ ".

    11. SST again to see the required 2 Byte non – standard
        instruction "STO N".

    12. BST & SST deleting the unwanted instructions around
        your 2 Byte instruction.

H. Create Non – Standard Global Labels, including being
    able to XEQ (or) GTO them !!

    Firstly one must assign 5 keys using the key assignment
    program. XEQ "KA", when "Key 1" appears in display, key
    in the "RCL M" assignment as follows:
    Key in 144 Enter up, 117 Enter up, & the keycode of the
    key to which you wish to assign it, e.g. key 11 = $\sum$ +
    key, key –11 = the shifted $\sum$ + key, key 12 = 1/x key
    etc.   then press R/S.
    When "Key 2" appears in display, key in the "STO Q"
    assignment as follows:
    Key in 145 Enter up, 121 Enter up, & the keycode,
    press R/S.
    "Key 3", the "Global Label" assignment:
    Key in 205 Enter up, Ø Enter up, & the keycode, press R/S.
    "Key 4", the "GTO Global Label" assignment:
    Key in 4 Enter up, 29 Enter up, & the keycode, press R/S.
    "Key 5", the "XEQ Global Label" assignment:
    Key in 4 Enter up, 30 Enter up, & the keycode, press R/S.

    THE 1ST METHOD, (up to 7 characters).

    1. XEQ "NN", then for each character required in the Non –
       Standard Label, key in the decimal address (No.),
       pressing R/S after each decimal entry (you will find
       these decimal addresses directly above the centre
       character on the Hex Chart). N.B. Enter the decimal
       equivalents, in the reverse order (up to 7 characters);
       e.g. if you required "Lbl GEO!" you would key in decimal
       33 = to the !, R/S. Decimal 79 = to the O, R/S, Decimal
       69 = to the E, R/S & Decimal 71 = to the G, R/S.

    2. When label characters are complete, go into Alpha mode &
       check that they are correct (if they are not you will
       need to XEQ "NN" again & recreate the characters, don't
                                  cont! o/leof

H.   forget enter in reverse order as above example).

3. When text line in Alpha is correct & complete (in
   reverse order); come out of Alpha mode & GTO the
   line in the program where the non — standard global
   label is required.

4. In run mode & in user mode, press the "RCL M" assigned
   key, press the "STO Q" assigned key, go into program
   mode & press either:
   a. "Global Label" assigned key, b. "GTO Global Label"
   assigned key (or) c. "XEQ Global Label" assigned key,
   whichever you require & there you have it !! e.g.
   construct a non — standard Global Label, following the
   above instructions, then construct a matching GTO, or
   XEQ as follows: In run mode & in user mode, press the
   "RCL M" assigned key, then the "STO Q" assigned key. Go
   into program mode & press either the b or c key, as
   noted above.

The following 2nd simpler method allows you to make Non —
Standard Global Labels of up to 6 Characters.

Firstly one must assign 3 keys using the key assignment
program.
XEQ "KA", when "Key 1" appears in display, key in the
"Global Label" assignment as follows:
Key in 205 Enter up, Ø Enter up & the keycode of the key
to which you wish to assign it e.g. Key 11 = Σ + key, Key
−11 = the shifted Σ + key, Key 12 = 1/x key, etc. press R/S.
When "Key 2" appears in display, **key in the "GTO Global
Label"** assignment as follows:
Key in 4 Enter up, 29 Enter up, & the keycode R/S.
"Key 3", the "XEQ Global Label" assignment:
Key in 4 Enter up, 30 Enter up, & the keycode R/S.

1. XEQ "NN", then for each character required in the Non —
   Standard Label, key in the decimal address (No.), (you
   will find these decimal addresses directly above the
   centre character on the Hex Chart). Unlike the previous
   method, you must enter the decimal equivalents in the
   order in which you wish them to appear in your label,
   pressing R/S after each decimal entry, (up to 6
   characters); e.g. if you require "Lbl GEO! you would
   key in Decimal 71 = to the G, R/S, Decimal 69 = to the
   E, R/S, Decimal 79 = to the O, R/S, & Decimal 33 = to
   the !, R/S.

H. 2. When label characters are complete, go into Alpha
       mode & check that they are correct (if they are not
       you will need to XEQ "NN" again & recreate the
       characters, don't forget to enter the decimal
       equivalents in the order in which you wish them to
       appear in your label, as example on previous page).
    3. When the text line in Alpha is complete & correct
       come out of Alpha mode & GTO the line in the program
       where the non – standard label is required.
    4. In run mode & in Alpha mode, key in "ASTO X"
       instruction, then come out of Alpha mode & key in
       "GTO IND X" instruction, this produces "NONEXISTENT"
       in the display, ignore this.
    5. Go into program mode & press either the "Global Label"
       assigned key, the "GTO Global Label" assigned key or
       the "XEQ Global Label" assigned key.

I. Create Non – Standard Global Labels A – J, a – e, using
    an assigned key.

    Firstly one must assign a key using the key assignment
    program.
    XEQ "KA", & when "Key 1" appears in display, key in the
    "Global Label" assignment as follows:
    Key in 205 Enter up, Ø Enter up, & the keycode of the
    key to which you wish to assign it e.g. Key 11 = Σ +
    key, Key –11 = the shifted Σ + key, Key 12 = 1/x key
    etc.
    GTO the line in the program where the Global Label is
    required. Key in the local label equivalent of the
    Global Label required, then simply press the "Global
    Label" assigned key, there you have it.
    Now BST & delete the unwanted local label.
    e.g. Key in "Lbl A", then press the "Global Label"
         assigned key, see "Lbl ^{T}A".
         If you now assign "A" to a key, then press this
         assigned key, you will get "XEQ ^{T}A".

J. Create a Non – Standard Global Label using the Byte –
    Jumper. (The label can then be assigned to a key).
    1. Have you carried out Section "A" if not go back & do so.
    2. Go into program mode, at line where Non – Standard
       Global Label is required.
    3. Key in an x< >y instruction, then in Alpha mode the text

J.   "ABCDE". Note this line No. for you have to come
      back to it.

4. With this text line in view, go into run mode &
   in user mode, press the key to which you assigned
   the Byte – Jumper (hereafter written as "Byte – Jump").

5. Come back into program mode & see:– –

6. Key in "Lbl N" instruction (if more than one character
   is required in the label, simply key in an Alpha
   character for each Non – Standard character, e.g. if
   2 characters are required in the label, key in "Lbl NN",
   if 3 characters are required, key in "Lbl NNN" etc.
   N.B. If you wish to assign this label to a key, simply,
   in program mode, assign Alpha "N" Alpha & press the key
   to which you wish to assign it, now (for you cannot do
   it later in this procedure).

7. GTO. (line No. of the text "ABCDE", it will appear in a
   Non – Standard form, you must not BST, if you do you will
   place the program pointer in the status registers.
   If however you do this by accident, come out of program
   mode & GTO.. when display normalises, GTO Alpha "The
   Program Name" Alpha, & start again).

8. Key in the "stand alone" instructions that equal the Non –
   Standard characters of your label (you will find these
   instructions directly below the centre character on the
   Hex Chart).

9. Go through step 7 again.

10. Go into run mode & in user mode, Byte – Jump.

11. Come back into program mode, and again see:– | – |

12. Key in a "+" instruction, then SST to see your
    required Global Label.

13. SST & BST deleting the unwanted instructions around
    your label.

14. If you press your assigned key, you will get "XEQ Lbl _ ".

K.   Save a Byte when entering Exponents using the Byte – Jumper !!

1. Have you carried out Section "A" if not go back & do so.

2. Go to the line in the program, where the exponent entry is
   required.

3. Key in an x<>y instruction, then in Alpha mode the text
   "ABC", then come out of Alpha mode.

4. With the text line in view, go into run mode & in user mode,
   press the key to which you assigned the Byte – Jumper.

5. Come back into program mode, see :– | – |

K. 6. Key in your EEX entry, e.g. press the EEX key & fill
        the prompts with the digit you require from 1 - 99 or
        -1 to -99.

   7. BST, see x<>y, SST, to see the text line "A⁻▨ ".

   8. SST again to see your E1 - E99 or E-1 to E-99,
        (optional).

   9. BST & SST around your EEX instruction, deleting the
        unwanted instructions.

L. Use the "Q" Loader.

Firstly one assigns 2 keys using the key assignment
program.
XEQ "KA" & when "Key 1" appears in the display key in
the "STO Q" assignment as follows:
Key in 145 Enter up, 121 Enter up, & the keycode of the
key, you wish to assign it, e.g. Key 11 = Σ + key, Key -11
= the shifted Σ + key, Key 12 = 1/x key etc. Press R/S.
When "Key 2" appears in display, key in the digit "5"
assignment as follows:
Key in 4 Enter up, 21 Enter up, & the keycode, press R/S.

Having now assigned these 2 keys, you can now make up a
non - standard text line in a program, in a different
way (as opposed to the Byte - Jumper).
However this method is limited to a 7 character text,
but you don't need to enter the text prefix, decimal Nos.
240 - 255 (decimal addresses along the bottom row of the
Hex Chart), this is of great value when one is keying up
a text line, where a decimal 240 - 255 is used as a
character in a text line e.g. ▨↙天∠天 !已, =
Decimal 247, 248, 13, 1, 60, 1, 33 & 64 ref. PPCJ V7,
N 5, P 18 (Valentin Albillo's Display Test Program).
Forgetting the text prefix, (247 = to a 7 character text
line), you would enter this line as follows: XEQ "NN" &
key in Decimal 64, R/S, 33, R/S, 1, R/S, 60, R/S, 1, R/S,
13, R/S, 248 R/S.

   N.B. As above example shows, you must enter your decimal
        No. equivalents of the text characters in Reverse
        Order. You will find these decimal addresses (Nos.)
        directly above the centre character on the Hex Chart.

   2. When the text line is complete, go into Alpha mode &
        check that it is correct (it will be in the reverse

L.   If they are not correct, you will need to XEQ "NN"
     again & recreate the characters, (don't forget to
     enter them in reverse order).

3.   Come out of Alpha mode & GTO the line in the program
     where the Non — Standard Text is required, & whilst
     in run mode & in user mode, press the "STO Q"
     assigned key, then go into program mode & press the
     "5" assigned key, delete the 5, then SST to see your
     Non — Standard text line.

M.   Use the routine "little b2" to place Non — Standard Text
     Lines up to 15 characters in your programs.
     written by: John Mc Gechie (3324), & updated by Richard
     Collett (4523).

1.   One must assign "RCL b" to a key using the key
     assignment program.
     XEQ "KA" & when "Key 1" appears in display,
     key in 144 Enter up, 124 Enter up, & the keycode of
     the key to which you wish to assign it e.g. Key 11 =
     Σ + key, Key -11 = the shifted Σ + key, Key 12 = 1/x
     key, etc.   then press R/S.

2.   Write your Non — Standard text on a piece of paper,
     placing beneath each character it's decimal number
     equivalent (these decimal Nos. are to be found
     directly above the centre character on the Hex
     Chart). Then write down the text prefix as the
     leftmost number, in your row of decimal numbers,
     e.g. 242 = a 2 character text, 247 = a 7 character
     text, 250 = a 10 character text, 252 = a 12
     character text, through to 255 which is the
     equivalent of a 15 character text.
     Section them off into groups of 7 characters
     starting at the right end of your text.

3.   XEQ "NN" then enter the decimal equivalents of the
     last 7 characters in your Non — Standard text line,
     pressing R/S after each decimal number entry.

4.   When this section of your text is complete, go into
     Alpha mode & check that it is correct, (if not you
     must XEQ "NN", again & recreate this section of your
     text, come out of Alpha mode.

5.   Go to the line in the program where the non —
     standard text is required.

M.   7. Go into run mode & in user mode XEQ "PACK", then
        press the "RCL b" assigned key.

     8. Then XEG "b2", the prompt "Y = NNN, X = Rb?" will
        appear in the display, this is asking you, have
        you placed your non — normal number in the "Y"
        register, & have you recalled "b" into the "X"
        register, if so press R/S. this will place the
        "stand alone" instruction equivalents of your
        decimal No. entries into the required program.

     9. XEQ "NN" again entering the decimal equivalents
        of the next set of characters to the left of
        the first 7 you entered, then go through step
        10, then 4, 7 & 8 again. If there are more
        characters remaining repeat steps 4, 7 & 8
        repeatedly. Treat the text prefix as a character!!

    10. Go to the "+" instruction immediately before
        the 1st "stand alone" instruction, that relates
        to your text.

    11. BST & SST around your text line deleting the
        "+" instructions.

Create a Byte — Jumper without the use of a Card Reader or any RAMS.(Modules).

Jim Trainor's original method improved.

N.B. This method does not disturb program memory,
        nor does it affect existing assignments.

1. Assign Alpha "+" Alpha & press the key to which
   you wish to assign the Byte — Jumper.

2. Assign Alpha "LN" Alpha (or any dummy assignment),
   & press any unassigned key.

3. XEQ Alpha "space" Alpha & immediately you release
   your finger from the Alpha toggle, disconnect the
   power source.

4. After a few seconds reconnect the power source, the
   display will show │ XEQ   │ .

5. Place one finger on the delete key, & another on the
   R/S key, press the delete key then immediately after,
   press the R/S key.
   If you aren't fast enough in pressing the R/S key
   "NONEXISTENT" appears in the display, in which case
   go back & continue from step 3.   GTO.006

6. Go into program mode & see "+", (if you have keys
   already assigned, SST 'til you find the "+" sign),
   delete this then you will see "Lbl 03" in display,
   delete this also.

7. When the display normalises to │ 04   1   │ , go
   into Alpha mode & press "A". * See overleaf.

8. Come out of Alpha mode & GTO..

9. Come back into run mode & in user mode, hold down
   the key to which you assigned the Byte — Jumper,
   you will see "XROM 05,01" this is your Byte —
   Jumper.

Create a Byte Jumper without a Card Reader. The Module (RAM) Pulling Method.

1. Master Clear, by holding down the delete key whilst
   turning the machine on.

2. XEQ "SIZE", display will show "SIZE _ _ _ " , fill
   the prompts with "000".

3. Assign 2 keys, e.g. "LN" to the 1/x key
                     "LOG" to the Σ + key

4. Turn the 41C off.

5. Take out a Module (RAM) & wait approx. 20 seconds.

6. Place the module back in the 41C.

7. Switch the machine on & go into program mode.

8. SST, see [_____01] you will then wait
   approx. 10 seconds before the display normalises.

9. Once the display normalises to [01 ͭ _____] .
   SST again & after approx. a 6 second wait see
   [02 Lbl 03] .

10. SST a 3rd time to see [03   LOG   ] .

11. Then delete the "LOG" instruction, presently in
    view (deletion takes about 6 seconds), then
    delete the "Lbl 03" instruction, the display then
    returns to what it was in step 8.

12. When the display normalises to [01 ͭ _____] ,
    go into Alpha mode & press the Σ + key, wait, then
    see [02 ͭ A_____] .

13. Come out of Alpha mode & GTO.. (this appears in
    display for approx. 9 seconds).

14. Come back into run mode & press assign Alpha Alpha,
    & press the 1/x key (this unassigns the key).

15. In user mode, hold down the Σ + key & see
    "XROM 05,01" this is your Byte — Jumper.

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*   If other assignments have been made, the display
    will normalise to something other than shown on
    the previous page, this is of no consequence !!

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